APPENDIX A

HABITAT EVALUATION PROCEDURES FOR THE HAMILTON ARMY AIRFIELD WETLAND RESTORATION PROJECT

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SUMMARY OF ALTERNATIVES

There are five alternatives for the Hamilton Army Airfield Wetland Restoration Project (project): 1) no action; 2) natural sedimentation at the HAAF site; 3) natural gradient (dredged material) at the HAAF site; 4) natural sedimentation at the HAAF and SLCP sites; 5) natural gradient at the HAAF and SLCP sites. The project would restore up to about 829 acres of tidal salt marsh and seasonal wetlands. Existing levees may be raised and new levees constructed around the site's perimeter. The re-establishment of tidal salt marsh would require higher elevations than currently exist, to allow for wetland vegetation growth. These elevations would be achieved by breaching the existing bayfront levee to allow tidal activity to deposit sediments. A detailed description of each alternative is found in the main body of the report.

METHODOLOGY

An interagency HEP team was formed for the J.F. Baldwin Deepwater Ship Channel Project, HAAF alternative. This team consisted of staff from the Service's Fish and Wildlife Office in Sacramento; the Army Corps of Engineers' San Francisco District Office; and the California Department of Fish and Game (Department) in Yountville. HEP team activities were carried out in May 1998. The following goals and objectives were established by the HEP team for the Baldwin project, and are pertinent to the Hamilton Army Airfield Wetland Restoration project:

1. The objective of using a HEP analysis is to provide a quantitative basis for replacing the habitat values which would be replaced by the creation of new cover-types.

2. The replacement of adversely impacted seasonal wetlands would be the first priority. The goal will be no net loss of in-kind habitat value or acreage (Resource Category 2).

3. The goals of the project are the creation of new cover-types including high marsh, low marsh, and tidal channels.

4. Cover-types to be created would benefit species of special concern such as the California clapper rail and the salt marsh harvest mouse (uplands would benefit the salt marsh harvest mouse, *i.e.*, escape cover).

A number of key assumptions were made for this study which were integral for this HEP application; they are as follows:

General

1. For Alternatives 3 and 5, the life of the project is 50 years; the HEP analysis period is 50 years; the total construction period is 6 years; the period of analysis is 56 years. For Alternatives 2 and 4, the life of the project is 50 years; the HEP analysis period is 50 years; the

total construction period is 2 years; the period of analysis is 52 years (E. Jolliffe, pers. comm.).

2. The study area consists of the BRAC (***B***ase ***R***ealignment ***a***nd ***C***losure) property and the adjacent SLCP.

3. Material suitable for unconfined aquatic disposal would be acceptable for a wetlands creation program.

4. Annual and fescue grasslands are the same cover-type.

5. Until the site is delineated, there is 16 acres of seasonal wetlands at the SLCP.

Existing Conditions

1. Seasonal wetlands consist of western goldenrod wetland, sheep sorrel/6 weeks fescue wetland, creeping wildrye, and sedge-rush wetland (delineated by the Corps). Non-tidal emergent marsh consists of saltgrass-saltplant wetland, saltgrass-alkali heath wetland (delineated by the Corps), and the perimeter drainage ditch.

Future Conditions without the Project

1. Plans for the surrounding property are conceptual, therefore, the without-the-project conditions are that the airfield would remain as it is today.

Future Conditions with the Project

1. HEP is an acceptable method to use in determining habitat values at the project site.

2. Impact acres are the acres of habitat actually covered or otherwise disturbed by the disposal of dredged materials and by tidal inundation.

3. The cover-types acreages at the HAAF and SLCP were determined using aerial photographs, field observations, references and communication with experts knowledgeable about the extent and nature of the impacted habitat types. Of the total acres, about 80 percent would become tidal and 20 percent would be non-tidal.

4. Breaching of the perimeter levee would lead to the eventual creation of tidal marsh habitat where seasonal wetlands, uplands, drainage ditches, and developed lands currently exist.

5. Re-creation of salt marsh habitat is expected to occur fairly rapidly for the dredged material alternatives (Alternatives 3 and 5), due in part to the dredged material disposal at target year (TY) 6, and the significant accumulation of sediments carried by tidal action after the placement of dredged materials. After about 10 years from the levee breach, it is anticipated that cordgrass and pickleweed would revegetate much of the marsh plain, major slough

channels would be formed, and shallow ponded areas with some cordgrass at the head of the slough channels would be formed (Alternatives 3 and 5). For the natural sedimentation alternatives (Alternatives 2 and 4), less cordgrass and pickleweed, and more mudflats will be formed by TY 16. However, by TYs 25 and 27, for Alternatives 3 and 5 and Alternatives 2 and 4 respectively, habitat values and acreages would be fairly similar.

6. Intertidal and subtidal aquatic habitat would be created at the site through tidal inundation.

7. The concrete and asphalt on the HAAF site would not be removed prior to disposal of the dredged material.

8. The developed areas (runway, hangar facilities, airfield support buildings, asphalt and concrete) contain no habitat value and were not analyzed in the HEP.

9. All drainage ditches on the study site that would be impacted by the project are concrete-lined.

10. The total amount of dredged material would be disposed, on average, by about year 6.

11. Up to 11 million cys of dredged material would be disposed of at the HAAF and SLCP sites.

12. The large drainage ditch on the southern end of the HAAF property would not be impacted.

13. The created elevation would be comparable to existing outboard tidal emergent marsh habitat (*i.e.*, pickleweed).

14. On-site contaminants will be remediated prior to wetland restoration, and the remediation should be completed by the end of 1999.

15. Regional drainage from adjacent properties will be resolved by the Army.

16. Drainage from Landfill 26 will be resolved by the Corps.

17. The Novato Sanitary District dechlorination plant will be moved out of the project area.

18. Peninsulas will be constructed only at the HAAF site, and they will erode by TY16.

19. Impacts from creation of the outboard marsh tidal channels would be to mudflat and coastal salt marsh cover-types.

20. Impacts from creation of internal peninsulas would be to the mudflat cover-type, however, because the surface area of the peninsulas to be built are too small to calculate separately from other uplands habitat, it was appropriate to include it in the total of uplands habitat in the project area.

21. Pacheco Pond would not be impacted by the project.

22. Dredge material would have appropriate texture and chemistry that would result in successful establishment of target cover-types (*e.g.,* tidal emergent marsh, etc.).

23. Upland habitat at the SLCP has values similar to those found at the HAAF.

24. Permanent wetlands consist of shallow open water with permanent hypersaline ponds, and deep brackish open water.

25. The SLCP was inaccessible due to potential hazards from explosives, therefore, values obtained for cover-types at the HAAF were used for the same cover-types at the SLCP.

26. For the natural gradient alternatives (Alternatives 3 and 5), the nearest loafing area would be the created fill.

27. The perimeter drainage ditch to be constructed will consist of slightly better habitat values than the existing ditch contains.

28. There are no values for the uplands cover-type for the natural sedimentation alternatives (Alternatives 2 and 4) at TY1 and TY2, and for the natural gradient alternatives (Alternative 3 and 5) at TY1 under with-the-project conditions. Although there is some acreage, but it is very degraded, and there are existing levees, but these were not included in this assumption.

<u>HSI Models</u>

1. <u>Desert cottontail model</u>:
   V5 - Tall grasses constitute escape cover.
   V7 - Escape cover = Foraging cover

2. <u>Wintering shorebird guild</u>:
   V6 - Future with-the-project conditions: the created fill could be used for loafing sites.
   V7 - The footpath is not used, therefore, there are no disturbance factors.

3. <u>California ground squirrel</u>:
   V4 - This variable does not “fit” for the cover-type analyzed, therefore, the model was modified and the variable was eliminated for our purposes.

4. <u>Egret guild</u>:
   V5 - The footpath is not used, therefore, there are no disturbance factors.

5. <u>Juvenile English sole model</u>:

V1 - The study area is now at a low energy hydrodynamic regime. With the project, it will turn into an area of high energy, and then will be an area of intermediate energy within 10 years after construction activities are completed.

6. Wintering Mallard:
V2 - The depth of water was determined for the months between December and April

HSI MODEL SELECTION AND COVER-TYPE DESIGNATION

Table B-1 lists the HSI variables contained in each model and shows the method of collection. Most of the copies of the models can be found in USFWS 1998, and the others can be obtained from the Sacramento Fish and Wildlife Office. Each of the nine cover-type areas and their respective species or guild models designated for the HEP analysis are explained below.

a. Egret guild and salt marsh rail guild models. The egret guild (Roberts 1986a) and salt marsh rail guild (USFWS 1995) models were used to evaluate impacts to existing **tidal emergent marsh** vegetation and show the increase in Average Annual Habitat Units (AAHUs) from the restoration project. Gains in tidal habitat values would begin by TY 6 for Alternatives 2 and 4, and TY 6 for Alternatives 3 and 5, after the levees have been breached, and vegetation becomes established. At TY 6, however, there would be more salt marsh acreage with Alternatives 2 and 4. The egret guild accounts for several avian species found at the site, including the great egret and great blue heron. Factors considered focus on the suitability of foraging areas with water cover, the suitability of foraging areas without water cover, and the relative freedom of a site from disturbance due to the presence of people and domestic pets. The salt marsh rail guild focuses on the extent of tidal inundation.

b. Desert cottontail and wintering mallard models. The desert cottontail (USFWS 1985) and wintering mallard (USFWS 1986) models were used to evaluate impacts to **seasonal wetlands,** and the wintering mallard model was used to evaluate impacts to **tidal ponds** and **tidal pannes**. Seasonal wetlands refer to areas which are ponded during the winter season. Presumably, they provide some habitat values during the winter migratory season. Shallow ponding is a feature typical of large, subsided diked wetlands and varies from year-to-year. Surveys revealed no aquatic foragers since they were conducted during the dry season (September). The desert cottontail model takes into account percent escape cover, foraging area, and distance to a permanent water source. The wintering mallard model includes parameters which take into account the proportion of area flooded, the depth of flooding, and/or the flood frequency.

c. California vole, California ground squirrel, and western meadowlark models. The California vole (Garrison 1988), California ground squirrel (SCS 1980), and western meadowlark models were used to evaluate **uplands**. The uplands in the impact zone consist of grasslands that are of medium to high value to the evaluation species. Although uplands would be impacted, they would be replaced by habitat that is valuable to special status species, such as the California clapper rail. The California vole model was chosen because it is an appropriate forage organism for raptors present at the site. The model takes into account parameters that include average height and percent cover of herbaceous vegetation and soil type. The California ground squirrel model considers the abundance, availability, and diversity of food types; availability of free water; presence of burrows; and the presence of promontories. The western meadowlark model was chosen to represent an avian species that uses upland habitat, and takes

Table B-1. Variables used in the Hamilton Army Airfield Wetlands Restoration Project HEP.

VARIABLE	HOW OBTAINED
EGRET GUILD (non-tidal emergent marsh)	
V1-Percent of area with water 10-23 cm deep	Quadrat along line transect
V2-Percent of V1 having submerged or emergent vegetation	Quadrat along line transect
V3-Percent of year that habitat area has water over the surface	Assumption
V4-Percent of area with 20-50 cm tall herbaceous vegetation during summer.	Quadrat along line transect
V5-Percent of area >50 m from footpath or other disturbance source.	Aerial photo interpretation
SALT MARSH RAIL GUILD (tidal emergent marsh)	
V1-Percent of shore-line of persistent emergent wetlands that is bordered by tidal flats or exposed tidal channels.	Aerial photo interpretation
V2-Percent of area covered by persistent emergent wetlands.	Aerial photo interpretation, visual estimation
V3-Percent of emergent wetland within 15 m (49.2 ft) of tidally-influenced bodies of water.	Aerial photo interpretation
DESERT COTTONTAIL (seasonal wetlands)	
V1-Percent coverage of preferred herbaceous vegetation > 0.4 m tall.	Quadrat along line transect
V4-Percent coverage of rockpiles and fallen trees.	Visual estimation
V5-Edge availability-an index of the extent of edge between escape cover and foraging areas.	Visual estimation
V7-Distance between escape cover and foraging areas.	Visual estimation
V8-Distance to permanent water source or year-round source of succulent vegetation.	Aerial photo interpretation
WINTERING MALLARD (seasonal wetlands)	
V2-Water depth 1"-18" deep (percent of cropfield covered by water December to April)	Measurement along line intercept
V3-Flooding frequency.	Assumption
V4-Distance to resting cover.	Aerial photo interpretation
V7-Important food plant coverage in percent (flooded at least 1" deep)	Visual estimation, measurement along line intercept
CALIFORNIA VOLE (uplands)	
V1-Height of herbaceous vegetation.	Quadrat along line transect
V2-Percent cover of herbaceous vegetation.	Quadrat along line transect
V3-Soil type.	Literature search
V4-Presence of logs and other types of cover.	Visual estimation
CALIFORNIA GROUND SQUIRREL (uplands)	
V1 (food value)-The abundance, availability, and diversity of suitable food types within 137.2 m (150 yds) from the sample site.	Measurement along line intercept
V2 (water value)-The availability of free water.	Aerial photo interpretation
V3 (cover value)-The presence of burrows and the “openness” of the area within 137.2 m (150 yds) from the sample site.	Visual estimation
V4 (interspersion value)-The “open” character of the area within 137.2 m (150 yds) from the sample site and the presence of promontories.	Visual estimation
WESTERN MEADOWLARK (uplands)	

V1 - Height of herbaceous vegetation. V2 - Density of herbaceous vegetation. V3 - Abundance of singing perches.	Quadrat along line transect Quadrat along line transect Visual estimation

Table B-1 continued.

VARIABLE	HOW OBTAINED
JUVENILE ENGLISH SOLE (tidal channels to be created in salt marsh) V1-Hydrodynamic regime. V2-Dominant sediment type. V3-Bottom water temperature. V4-Bottom mean salinity. V5-Dissolved oxygen concentration.	 Assumption Assumption Assumption Assumption Assumption
WINTERING SHOREBIRD GUILD (mudflats) V1-Percent of area in exposed mud at mean low water. V5-Distance (m) from edge of site to outermost edge of land (salt marsh/upland interface). V6-Distance (m) from edge of site to closest known loafing site. V7-Percent of area >50 m from footpath or other disturbance source	 Aerial photo interpretation Aerial photo interpretation Aerial photo interpretation Aerial photo interpretation

into account height of herbaceous vegetation, density of herbaceous, and abundance of singing perches.

d. <u>Juvenile English sole model</u>. The juvenile English sole model (Toole *et al.*, 1987) was used to evaluate **tidal channels** and **subtidal habitat** that would be created by the restoration project. Juvenile English sole are found in estuarine and coastal areas throughout the northern Pacific Coast. This species utilizes shallow intertidal and subtidal habitats as cover and foraging areas, moves to deeper water locations as it matures. Variables measured are hydrodynamic regime, percent of substrate composition, water temperature, bottom mean salinity, and dissolved oxygen concentration.

e. <u>Wintering shorebird guild model</u>. The wintering shorebird guild model (Roberts 1986b) was used to evaluate **mudflat** and **tidal pannes** habitat that would be created with the project. This species was chosen because mudflats are important foraging areas for shorebirds. The model's parameters take into account percentage of area in exposed mud at mean low water; distance from outer edge of site to outermost edge of land; distance to nearest known loafing site; and disturbance.

The capacity of each sample site to meet the needs of the HEP evaluation species within the project impact and compensation areas was determined by the HEP team through measurement of specific habitat variables contained in the HSI models. These measurements were derived by field sampling, visual observations and estimations, aerial photography interpretation, review of existing records, and communication with experts knowledgeable about the study area

HSI CALCULATIONS

Alternative 2, Natural Sedimentation with Cross-levee, HAAF

1. A. UPLANDS - WITHOUT THE PROJECT (PA1)

a) California Ground Squirrel Model (SCS 1980)

TY0 (258.7 acres) - Baseline

V1 - *The abundance, availability, and diversity of suitable food types within 150 yards from the sample site* - Suitable food types appear to be scarce and not available within 150 yds (average of sample sites) avg. SI = 0.04

V2 - *The availability of free water within 0.25 mile from the sample site* - It was visually estimated that, on average, free water is available just beyond 0.25 mile within the project area. avg. SI = 0.52

V3 - *The presence of burrows and the "openness" of the area within 150 yds from the sample site* - It was visually estimated that, on average, the grasses and forbs in the project area are taller than 2 feet and lack runways, and burrows are scarce or unavailable. avg. SI = 0.22

V4 - *The "open" character of the area within 150 yds from the sample site and the presence of promontories* - The site was determined to be partially open with open grassy areas not interspersed with dense stands of trees and shrubs. Avg. SI = 0.02

$$HSI = \frac{(V1 + V2 + V3 + V4)}{4} = \text{(sample site with free water available within 0.25 mi)}$$

$$HSI = \frac{(V1 + V3 + V4)}{3} = \text{(sample site without free water available within 0.25 mi)}$$

Avg. HSI = 0.21

TY's 1, 2, 6, 16, 27, and 52 are all assumed to be equal to baseline conditions, HSI = 0.21

b) California Vole Model (Garrison 1988)

TY0 (258.7 acres) - Baseline

V1 - *Average height of herbaceous vegetation* - is estimated to be about >6", SI = 1.0

V2 - *Percent cover of herbaceous vegetation* - Percent cover was estimated to be about 96%, SI = 0.96

V3 - *Soil type within sample area* - Literature search revealed that the soils on most of the HAAF are classified as Xerorthents, clay loams, and gravelly loams, SI = 1.0

V4 - *Presence of logs and other types of cover within the sample area* - Logs, brush piles, matted vegetation, and/or rocks are moderately to well-distributed throughout the sample area, SI = 0.81

$$HSI = \frac{2V1 + 2V2 + V3 + V4}{6} = \frac{2.0 + 1.92 + 1.0 + .81}{6} = 0.96$$

TY's 1, 2, 6, 16, 27, and 52 are all assumed to be equal to baseline conditions, thus, HSI = 0.96

c) Western Meadowlark Model (USFWS 1980)

TY0 (258.7 acres) - Baseline.

V1 - *Height of herbaceous vegetation* - > 8", SI = 1.0

V2 - *Density of herbaceous vegetation*, >90%, SI = 1.0

V3 - *Abundance of singing perches*, between 2.5 and 3 perches, SI = 0.70

$$HSI = \underline{(V1 \times V2)^{1/2} + V3} = \underline{(1 \times 1)^{1/2} + 0.70} = 0.85$$

2 2

TY's 1, 2, 6, 16, 27, and 52 same as TY0, HSI = 0.85

1. B. UPLANDS - WITH-THE PROJECT (PA2)

a) California Ground Squirrel Model (SCS 1980)
TY0 (258.7 acres) - HSI same as PA1 = 0.21

TY1 (293.3 acres) - Area is graded over, only levee upland values remain, but assume zero values to simplify, HSI = 0

TY2 (141.5 acres) - Levee is breached, still no values except on levees, HSI = 0

TY6 (35.8 acres), TY16 (35.8 acres), TY27 (35.8 acres), and TY52 (35.8 acres) - Only levees remain as upland habitat. Same as TY0, HSI = 0.21

b) California Vole Model (Garrison 1988)
TY0 (258.7 acres) - baseline, same as PA1, HSI = 0.96

TY1 (293.3 acres) - Area is graded over; levees remain as only upland habitat. Assumed all habitat is degraded and did not include levees as having any value, for simplification, HSI = 0

TY2 (141.5 acres) - Levee is breached, HSI = 0

TY6 (35.8 acres), TY16 (35.8 acres) (peninsulas have eroded away), TY27 (35.8 acres), and TY52 (35.8 acres) - Levees remain as only upland habitat. Same as TY0, HSI = 0.96

c) Western Meadowlark Model (USFWS 1980)
TY0 (258.7 acres) - HSI same as PA1 = 0.85

TY1 (293.3 acres) - Area is graded over; only levees remain as upland habitat. HSI = 0

TY2 (141.5 acres) - Levee is breached. HSI = 0

TY6 (35.8 acres), TY16 (35.8 acres), TY27 (35.8 acres), and TY52 (35.8 acres) - Levees remain as only upland habitat. Same as TY0, HSI = 0.85

2. A. SEASONAL WETLANDS - WITHOUT-THE-PROJECT (PA1)

a) Wintering Mallard Model (USFWS 1986)
TY0 (32.5 acres) - Baseline. Seasonal wetlands are located at the Landfill 26 mitigation site and are scattered throughout the HAAF.

V2 - *Percent of wetlands covered by water from December - April* - It was assumed it is wet 100% of the time between these months. SI = 1.0
V3 - *Flooding frequency* - It was assumed that water is present annually. SI = 1.0
V4 - *Distance to resting cover* - The average distance is 3.0 miles, SI = 0.70
V7 - *Percent important food plant coverage* - 47%, SI =0.82

HSI =V4 $(V3 \times V2 \times V7)^{1/3} = 0.70\ (1.0 \times 1.0 \times .82)^{1/3} = 0.66$

TY's 1, 2, 6, 16, 27, 52 are all assumed to be equal to baseline conditions, HSI = 0.66

b) Desert Cottontail (USFWS 1985)
TY0 (32.5 acres) - Baseline.

V1 - *Percent coverage of preferred herbaceous vegetation 0.4m tall* - Average of percent coverage from the three seasonal wetlands is 43%, SI = 0.43
V4 - *Percent coverage of rockpiles and fallen trees* - There are no rockpiles or fallen trees within the three seasonal

wetlands areas. SI = 0

V5 - *Edge availability* - There is 1 edge, SI = 0.07

V7 - *Distance between escape cover and foraging areas* - The average is about 52', SI = 0.90

V8 - *Distance to permanent water source or year-round source of succulent vegetation* - The average of the SIs for the distance from each seasonal wetland is 50', SI = 0.93

HSI (Food) = V1(V7 x V8)^{½} = 0.43 (0.90 x 0.93)^{½} = 0.39
HSI (Cover) = (V5 x V4)^{½} = (0.07 x 0)^{½} =0
HSI = 0 (HSI value is equal to the lowest of the values for the food and cover components).

TY's 1, 2, 6, 16, 27, 52 are all assumed to be equal to baseline conditions, HSI = 0

2. A. <u>SEASONAL WETLANDS - WITH-THE-PROJECT</u> (PA2)

a) <u>Wintering Mallard Model (USFWS 1986)</u>
TY0 (4.1 acres) - Baseline, same as for PA1, HSI = 0.66

TY1 (0 acres) - Area is graded over, no seasonal wetlands, HSI = 0

TY2 (0 acres) - Levee is breached, no seasonal wetlands, HSI = 0

TY6 (43.2 acres) - The area would be intensively managed to recover seasonal wetland values. Management actions would consist of: grading the entire wetland sites; constructing depressions on the land to pond water; actively pumping water on to the site; excavating ditches to hold water throughout the year; and planting emergent vegetation along the edges.
V2 - 100%, SI = 1.0
V3 - water present annually, SI = 1.0
V4 - between 0-1 mi, SI = 0.95
V7 - about 80% of the vegetation planted would be food plants for the mallard, SI = 1.0

HSI = 0.95 (1.0 x 1.0 x 1.0)$^{1/3}$ = 0.95

TY16 (43.2 acres), TY27 (43.2 acres) TY52 (43.2 acres) would be the same as TY6, HSI = 0.95

b) <u>Desert Cottontail (USFWS 1985)</u>
TY0 (32.5 acres) - Baseline, same as PA1, HSI = 0

TY1 (0 acres) - Area is graded over, so no seasonal wetlands remain, HSI = 0

TY2 (0 acres) - Levee is breached, no seasonal wetlands, HSI = 0

TY6 (43.2 acres) - Vegetation has become well-established.
V1 - 90%, SI = 0.90
V4 - 40-60%, SI = 1.0
V5 - 5 edges, SI = 1.0
V7 - 0 feet, SI = 1.0
V8 - 0 feet, SI = 1.0

HSI (food) = 0.90 (1.0 x 1.0)^{½} = 0.90
HSI (cover) = (1.0 x 1.0)^{½} = 1,0
HSI = 0.90

TY's 16 (43.2 acres), 27 (43.2 acres), and 52 (43.2 acres) - same as TY6, HSI = 0.90

3. A. <u>TIDAL EMERGENT MARSH - WITHOUT-PROJECT</u> (PA1)

a) <u>Salt Marsh Rail Guild (USFWS 1995)</u>
TY0 (3.0 acres, outboard of the levee) - Baseline

V1 - *Percent of shoreline of salt marsh vegetation that is bordered by tidal flats or exposed tidal channels* - This area is 100%, SI =1. 0

V2 - *Percent of area covered by salt marsh vegetation* - Total area of salt marsh (3.0 acres) divided by entire project area (596.2 acres) = 1%, SI = 0.10

V3 - *Percent of salt marsh vegetation within 49.2 feet of tidally-influenced bodies of water* - 100%, SI = 1.0

HSI = $(V1 \times V2 \times V3)^{1/3} = (1.0 \times 0.10 \times 1.0)^{1/3} = 0.46$

TY's 1, 2, 6, 16, 27, 52 are all assumed to be equal to baseline conditions, HSI = 0.46

b) <u>Egret Guild (Roberts 1986a)</u>

TY0 (3.0 acres, outboard of the levee) - Baseline

V1 - *Percent of area with water 10-23 cm deep* - Salt marsh (3.0 acres) + mudflats (14.3) divided by entire project area (596.2) = 3%, SI = 0.03

V2 - *Percent of V1 having submerged or emergent vegetation* - Salt marsh (3.0 acres) divided by salt marsh (3.0 acres) + mudflats (14.3 acres) = 17%, SI = 0.72

V3 - *Percent of year that habitat area has water over the surface* - 100%, SI = 0.10

V4 - *Percent of area with 20-50 cm tall herbaceous vegetation during summer* - 80-100%, SI = 1.0

V5 - *Percent of area greater than 50 cm from a footpath or other disturbance source* - 31%, SI = 0.26

$$HSI = \frac{2[(V1 \times V2)^{1/2} \times V3] + V4 + V5}{5}$$

$$HSI = \frac{2[(0.03 \times 0.72)^{1/2} \times 0.10] + 1.0 + 0.26}{5} = 0.26$$

TY's 1, 2, 6, 16, 27, 52 are all assumed to be equal to baseline conditions, HSI = 0.26

3. B. <u>TIDAL EMERGENT MARSH - WITH-THE-PROJECT</u> (PA2)

a) <u>Salt Marsh Rail Guild (USFWS 1995)</u>

TY0 (3.0 acres, outboard of the levee) - Same as baseline, HSI = 0.46

TY1 (3.0 acres, outboard of the levee) - Site preparation begin; levees not yet breached; no recovery of salt marsh habitat yet on interior of levee yet, HSI = 0.46

TY2 (0 acres) - Levee breached, no coastal salt marsh vegetation established yet, HSI = 0

TY6 (20.4 acres) - Peninsulas are constructed; minimal salt marsh recovery on the disposal site has occurred.

V1 = 50-100%, SI = 1.0

V2 = area of salt marsh (20.4 acres) divided by entire project area (596.2 acres) = 3%, SI = 0.03

V3 = levee is breached, 100%, SI = 1.0

HSI = $(1 \times 0.03 \times 1.0)^{1/3} = 0.31$

TY16 (196.4 acres) - Peninsulas have eroded away. Natural recovery is underway, with areas of mid-marsh (cordgrass) growing.

V1 - Same as baseline, SI = 1.0

V2 - Total area of salt marsh (196.1 acres) divided by the entire project area (596.2 acres) = 33%, SI = 0.33

V3 -100%, SI = 1.0

HSI = $(1.0 \times 0.33 \times 1.0)^{1/3} = 0.69$

TY27 (395.2 acres) - Mature channel network established; large subtidal slough channels; intertidal marsh fully developed; tidal ponds beginning to develop.

V1 - same as baseline, SI = 1.0

V2 - total area of salt marsh (395.2 acres) divided by entire project area (596.2) = 66%, SI = 0.66

V3 - 100%, SI = 1.0

HSI = $(1.0 \times 0.66 \times 1.0)^{1/3} = 0.87$

TY52 (395.2 acres) - Same as TY27, HSI = 0.87

b) Egret Guild (Roberts 1986a)
TY0 - (3.0 acres, outboard of the levee), same as for PA1, HSI = 0.26

TY1 (3.0 acres, outboard of the levee) - Site preparation begins, levees not yet breached. No recovery of salt marsh habitat yet, inboard of the levee, HSI = 0.26

TY2 (3.0 acres) - Levee is breached, no coastal salt marsh habitat is established yet, HSI = 0
TY6 (20.4 acres) - Peninsulas are constructed, and minimal salt marsh recovery at the disposal site has occurred.
V1 - salt marsh (20.4 acres) + acres of mudflats (381.8) divided by the entire project area (596.2) = 67%, SI = 0.67
V2 - acres salt marsh (20.4) divided by total of salt marsh (20.4) + mudflats (381.8) = 5%, SI = 0.55
V3 - 100%, SI = 0.10
V4 - 33%, SI = 0.38
V5 - 90%, SI = 0.90

$$HSI = \frac{2[(0.67 \times 0.55)^{1/2} \times 0.10] + 0.38 + 0.90}{5} = 0.28$$

TY16 (196.4 acres) - Peninsulas eroded away. Natural recovery of salt marsh is underway, with areas of mid-marsh (cordgrass) growing.
V1 - Salt marsh (196.4 acres) + mudflats (198.8 acres) divided by entire project area (596.2 acres) = 66%. SI = 0.66
V2 - Salt marsh (196.4 acres) divided by salt marsh (196.4) plus mudflats (198.8 acres) = 50%. SI = 1.0
V3 - Between 100%, SI = 0.10
V4 - Between 75-100%, SI = 1.0
V5 - 95%, SI = 0.95

$$HSI = \frac{2[(0.66 \times 1.0)^{1/2} \times .10] +1.0 + 0.95}{5} = 0.42$$

TY27 (395.2 acres) - Mature channel network established; large subtidal slough channels formed; intertidal marsh fully developed.
V1 - salt marsh (395.2 acres) + mudflats (0 acres) divided by entire project area (596.2 acres) = 66%, SI = 0.66
V2 - salt marsh (395.2 acres) divided by salt marsh + mudflats (395.2 + 0) =100%, SI = 0.10
V3 - 100%, SI = 1.0
V4 - 75-100%, SI = 1.0
V5 - 95%, SI = 0.95

$$HSI = \frac{2[(0.66 \times 0.10)^{1/2} \times .10] + 1.0 + 0.95}{5} = 0.42$$

TY52 (395.2 acres) - Same as TY27, HSI = 0.42

4. A. TIDAL CHANNELS - WITHOUT-THE-PROJECT (PA1)

a) Juvenile English Sole (Toole *et al.* 1987)
TY0 (0 acres) - Baseline
V1 - *Hydrodynamic regime* - no tidal channel, SI = 0
V2 - *Substrate composition* - no tidal channels, SI = 0
V3 - *Water temperature* - no tidal channels, SI = 0
V4 - *Bottom mean salinity from April to October* - no tidal channels, SI = 0
V5 - *Dissolved oxygen concentration* - no tidal channels, SI = 0

HSI (food) = 0 (the lower of V1 and V2)
HSI (cover) = 0 (the lower of V3, V4 and V5)
HSI = 0 (the lower of food and cover)

TY's 1, 2, 6, 16, 27, 52 are all assumed to be equal to baseline conditions, HSI = 0

4. B. <u>TIDAL CHANNELS - WITH-THE-PROJECT</u> (PA2)

a) <u>Juvenile English Sole (Toole *et al.* 1987)</u>
TY0 (0 acres) - Same as PA1, HSI = 0

TY1 (0 acres) - Site preparation begins; levees not yet breached; tidal channels not yet formed, HSI = 0

TY2 (0 acres) - No channels formed yet, HSI = 0

TY6 (7.0 acres) - Levees are breached to allow tidal inundation; peninsulas are constructed; tidal channels begin to form.
V1 - high energy, SI = 0.20
V2 - 0-25% substrate composition, SI = 1.0
V3 - 2 months, SI = 0.70
V4 - 15-23 ppt, SI = 0.40
V5 - 0 months, SI = 1.0

HSI (food) = 0.20 (lower of V1 and V2)
HSI (water quality) = 0.40 (lower of V3, V4, V5)
HSI = 0.20 (lower of food and water quality)

TY16 (14.0 acres) - Peninsulas have eroded away. Natural recovery is underway, with areas of mid-marsh (cordgrass) growing.
V1 - intermediate energy, SI = 1.0
V2 - same as TY6, SI = 1.0
V3 - same as TY6, SI = 0.70
V4 - same as TY6, SI = 0.40
V5 - same as TY6, SI = 1.0

HSI (food) = 1.0
HSI (water quality) = 0.40
HSI = 0.40 (lower of food and water quality)

TY27 (14.0 acres)
V1 - low energy, SI = 0.30
V2 - same as TY16, SI = 1.0
V3 - same as TY16, SI = 0.70
V4 - same as TY16, SI = 0.40
V5 - same as TY16, SI = 1.0

HSI (food) = 0.30
HSI (water quality) = 0.40
HSI = 0.30 (lower of food and water quality)

TY52 (14.0 acres) - Same as TY27, HSI = 0.30

5. A. <u>MUDFLATS - WITHOUT-THE-PROJECT</u> (PA1)

a) <u>Wintering Shorebird Guild (Roberts 1986b)</u>
TY0 (14.3 acres, outboard of levee) - Baseline
V1 - *Percentage of area in exposed mud at mean low water* - acreage of mudflat (14.3) divided by acreage of entire project area (596.2) = 2%, SI = 0
V5 - *Distance from outer edge of site to outermost edge of land* - the distance from the outermost edge of the mudflat site would be located within 61 meters of the edge of the bay, SI = 1.0
V6 - *Distance from edge of site to nearest known loafing site* - this distance would be about 450' (137 m), SI = 1.0
V7 - *Percentage of study area > 50 m from footpath or other disturbance source* - Entire area would be greater than 50 m from any disturbance (100%), SI = 1.0

$$HSI = \frac{2(\max\{[(V2 \times V3)^{1/2} \times V4] \text{ or } [V1]\} + \frac{2\ (V5 \times V6)^{1/2} + V7}{3}}{3}$$

$$HSI = \frac{2(0) + \frac{2\ (1.0 \times 1.0)^{1/2} + 1.0}{3}}{3} = 0.33$$

TY's 1, 2, 6, 16, 27, and 52 are all assumed to be equal to baseline conditions, HSI = 0.33

5. B. <u>MUDFLATS - WITH-THE-PROJECT</u> (PA2)

a) <u>Wintering Shorebird Guild (Roberts 1986b)</u>

TY0 (14.3 acres, outboard of the levee) - Baseline. Same as PA1, HSI = 0.33
TY1 (14.3 acres, outboard of the levee) - Site preparation begins; levees not yet breached. Same as TY0, HSI = 0.33

TY2 (77.0 acres) - Levee is breached, some mudflats form.
V1 - acres mudflats (77.0) divided by acres of entire project area (596.2) = 13%, SI = 0.13
V5 - within 400 m, SI = 1.0
V6 - within 400 m, SI = 1.0
V7 - 95%, SI = 0.95

$$HSI = \frac{2 \times V1 + \frac{2(V5 \times V6)^{1/2} + V7}{3}}{3} = \frac{2\ (0.13) + \frac{2(1{,}0 \times 1.0)^{1/2} + 0.95}{3}}{3} = 0.41$$

TY6 (381.8 acres) - Peninsulas are constructed.
V1 - acreage of mudflat (381.8) divided by acreage of entire project area (596.2) = 64%, SI = 0.70
V5 - the distance from the outermost edge of the mudflat site would be located within 400 meters of the edge of the bay, SI = 1.0
V6 - loafing sites are generally located near the bay margin; would be within 400 m, SI = 1.0
V7 - Almost all of the area would be greater than 50 m from any disturbance (95%), SI = 0.95

$$HSI = \frac{2(0.70) + \frac{2(1.0) \times 1.0)^{1/2} + 0.95}{3}}{3} = 0.79$$

TY16 (198.8 acres) - Peninsulas have eroded away. Natural recovery is underway.
V1 = acreage of mudflat (198.8) divided by acreage of entire project area (596.2) = 33%, SI = 0.33
V5 - same as TY6, SI = 1.0
V6 - same as TY6, SI = 1.0
V7 - same as TY6, SI = 0.95

$$HSI = \frac{2\ (0.33) + \frac{2(1.0\ .x\ 1.0)^{1/2} + 0.95}{3}}{3} = 0.55$$

TY27 (0 acres) - Mature channel network established; large subtidal slough channels; intertidal marsh fully developed, mudflats have disappeared, HSI = 0

TY52 (0 acres) - HSI same as TY 27 = 0

6. A. <u>TIDAL PONDS - WITHOUT-THE-PROJECT</u> (PA1)

a) <u>Wintering Mallard Model (USFWS 1986)</u>

TY0 (0 acres) - Baseline. HSI = 0

TY's 1, 2, 6, 16, 27, and 52 - Same as baseline, HSI = 0

6. B. <u>TIDAL PONDS - WITH-THE-PROJECT</u> (PA2)

TY0 (0 acres) - Same as PA1, HSI = 0

TY1 (0 acres) - Same as TY0, HSI = 0

TY2 (0 acres) - Same as TY1, HSI = 0

TY6 (0 acres) - Same as TY2, HSI = 0

TY16 (0 acres) - Same as TY6, HSI = 0

TY27 (0 acres) - Same as TY16, HSI = 0

TY56 (3.3 acres) - Ponds have formed
V2 - 100% of water is 1-18" deep, SI = 1.0
V3 - water is present annually, SI = 1.0
V4 - within 0-1 mile, SI = 1.0
V7 - between 75-100%, SI = 1.0

HSI = 1.0

7. A. <u>NON-TIDAL EMERGENT MARSH - WITHOUT-THE-PROJECT</u> (PA1)

a) <u>Wintering Mallard (USFWS 1986)</u>
TY0 (4.1 acres) - Baseline
V2 - 100%, SI = 1.0
V3 - water present annually, SI = 1.0
V4 - 0 mi, SI = 1.0
V7 - 34%, SI = 0.69

HSI = V4 (V3 x V2 x V7)$^{1/3}$ = 1.0 (1.0 x 1.0 x 0.69)$^{1/3}$ = 0.88

TY's 1, 2, 6, 16, 27, and 52 - HSI same as TY0 = 0.88

7. B. <u>NON-TIDAL EMERGENT MARSH - WITH-THE-PROJECT</u> (PA2)

a) <u>Wintering Mallard (USFWS 1986)</u>
TY0 (4.1 acres) - HSI same as PA1 = 0.88

TY1 (0 acres) - HSI = 0

TY2 (0 acres) - HSI = 0

TY6 (64.5 acres)
V2 - 100%, SI = 1.0
V3 - water present annually, SI = 1.0
V4 - 0 mi, SI = 1.0
V7 - 50%, SI = 0.80

HSI = 1 (1 x 1 x 0.80)$^{1/3}$ = 0.93

TY's 16, 27, and 52 - HSI same as TY6 = 0.93

8. A. <u>SUBTIDAL - WITHOUT-THE-PROJECT</u> (PA1)

a) <u>Juvenile English Sole Model (Toole *et al*. 1987)</u>
TY0 (0 acres) - HSI = 0

TY's 1, 2, 6, 16, 27 and 52, same as TY0 - HSI = 0

8. B. <u>SUBTIDAL - WITH-THE-PROJECT</u> (PA2)
a) <u>Juvenile English Sole Model (Toole *et al.* 1987)</u>
TY0 (0 acres) - Same as PA1, HSI = 0

TY1 (0 acres) - Same as TY0, HSI = 0

TY2 (375.5 acres) - Levee is breached, subtidal habitat is created.
V1 - high energy, SI = 0.20
V2 - 0-25% substrate composition, SI = 1.0
V3 - 2 months, SI = 0.70
V4 - 15-23 ppt, SI = 0.40
V5 - 0 months, SI = 1.0

HSI (food) = 0.20 (lower of V1 and V2)
HSI (water quality) = 0.40 (lower of V3, V4, V5)
HSI = 0.20 (lower of food and water quality)

TY6 (43.5 acres) - Same as TY2, HSI = 0.20

TY16 (43.5 acres) - Peninsulas have eroded away. Natural recovery is underway, with areas of mid-marsh (cordgrass) growing.
V1 - intermediate energy, SI = 1.0
V2 - same as TY6, SI = 1.0
V3 - same as TY6, SI = 0.70
V4 - same as TY6, SI = 0.40
V5 - same as TY6, SI = 1.0

HSI (food) = 1.0
HSI (water quality) = 0.40
HSI = 0.40 (lower of food and water quality)

TY27 (43.5 acres)
V1 - low energy, SI = 0.30
V2 - same as TY16, SI = 1.0
V3 - same as TY16, SI = 0.70
V4 - same as TY16, SI = 0.40
V5 - same as TY16, SI = 1.0

HSI (food) = 0.30
HSI (water quality) = 0.40
HSI = 0.30 (lower of food and water quality)

TY 52 (43.5 acres) - Same as TY27, HSI = 0.30

<u>Alternative 3, Natural Gradient with Dredged Material, HAAF</u>
1. A. <u>UPLANDS - WITHOUT THE PROJECT</u> (PA1)

a) <u>California Ground Squirrel Model (SCS 1980)</u>

TY0 (258.7 acres) - Baseline, HSI same as PA1, Alternatives 2, 4 and 5 = 0.21

TY's 1, 6, 16, 25 and 56 are all assumed to be equal to baseline conditions, HSI = 0.21

b) California Vole Model (Garrison 1988)
TY0 (258.7 acres) - Baseline, HSI same as PA1, Alternatives 2, 4 and 5 = 0.96

TY's 1, 6, 16, 25 and 56 are all assumed to be equal to baseline conditions, thus, HSI = 0.96

c) Western Meadowlark Model (USFWS 1980)
TY0 (258.7 acres) - Baseline, HSI same as PA1 Alternatives 2, 4 and 5 = 0.85

TY's 1, 6, 16, 25 and 56, same as TY0, HSI = 0.85

1. B. UPLANDS - WITH-THE PROJECT (PA2)

a) California Ground Squirrel Model (SCS 1980)
TY0 (258.7 acres) - HSI same as PA1 = 0.21

TY1 (293.3 acres) - Area is graded over, HSI = 0

TY6 (41.2 acres) - All dredge material has been placed; peninsulas are constructed; levees are breached. Upland habitat consists of levees only, HSI same as TY0 = 0.21

TY16 (41.2 acres), TY25 (41.2 acres), and TY56 (41.2 acres) - Upland habitat consists of levees only, same as TY6, HSI = 0.21

b) California Vole Model (Garrison 1988)
TY0 (258.7 acres) - Baseline, same as PA1, HSI = 0.96

TY1 (293.3 acres) - Area is graded over, only levees remain as upland habitat. To simplify, assumed no values since most of the uplands are now degraded, HSI = 0

TY6 (41.2 acres) - All dredge material has been placed; peninsulas are constructed; levees are breached; only levees remain as upland habitat. Same as TY0 = 0.96

TY16 (41.2 acres) - Peninsulas have eroded away. Same as TY6, HSI = 0.96

TY25 (41.2 acres) and TY56 (41.2 acres) - Same as TY16, HSI = 0.96

c) Western Meadowlark Model (USFWS 1980)
TY0 (293.3 acres) - HSI same as PA1 = 0.85

TY1 (293.3 acres) - Area is graded over, only levee remains as upland habitat, HSI = 0

TY6 (41.2 acres) - Levee is breached; all dredged material has been placed; only levee remains as upland habitat, HSI same as TY0 = 0.85

TY16 (41.2 acres) - Peninsulas have eroded away. Same as TY6, HSI = 0.85

TY25 (41.2 acres) and TY56 (41.2 acres) - HSI same as TY16 = 0.85

2. A. SEASONAL WETLANDS - WITHOUT-THE-PROJECT (PA1)

a) Wintering Mallard Model (USFWS 1986)
TY0 (32.5 acres) - Baseline. HSI same as PA1, Alternatives 2, 4 and 5 = 0.66

TY's 1, 6, 16, 25 and 56 are all assumed to be equal to baseline conditions, HSI = 0.66

2. Desert Cottontail (USFWS 1985)
TY0 (32.5 acres) - Baseline. HSI same as for PA1, Alternatives 2, 4 and 5 = 0

TY's 1, 6, 16, 25, and 56 are all assumed to be equal to baseline conditions, HSI = 0

2. B. SEASONAL WETLANDS - WITH-THE-PROJECT (PA2)

a) Wintering Mallard Model (USFWS 1986)
TY0 (32.5 acres) - Baseline, same as for PA1, HSI = 0.66

TY1 (0 acres) - Area is graded over, no seasonal wetlands, HSI = 0
TY6 (119.5 acres) - Levee is breached. All dredged material is placed. The area would be intensively managed to recover seasonal wetland values. Management actions would consist of: grading the entire wetland sites; constructing depressions on the land to pond water; actively pumping water on to the site; excavating ditches to hold water throughout the year; and planting emergent vegetation along the edges.

V2 - 100%, SI = 1.0
V3 - water present annually, SI = 1.0
V4 - between 0-1 mi, SI = 0.95
V7 - about 80% of the vegetation planted would be food plants for the mallard, SI = 1.0

HSI = $0.95(1.0 \times 1.0 \times 1.0)^{1/3} = 0.95$

TY16 (108.0 acres), 25 (82.7 acres), and 56 (62.0 acres) would be the same as TY6, HSI = 0.95

b) Desert Cottontail (USFWS 1985)
TY0 (32.5 acres) - Baseline, same as PA1, HSI = 0

TY1 (0 acres) - Site preparation begins, and existing wetlands are graded over, HSI = 0

TY6 (119.5 acres) - Vegetation has become well-established.

V1 - 90%, SI = 0.90
V4 - 40-60%, SI = 1.0
V5 - 5 edges, SI = 1.0
V7 = 0 feet, SI = 1.0
V8 - SI = 1.0

HSI (food) = $0.90(1.0 \times 1.0)^{1/2} = 0.90$
HSI (cover) = $(1.0 \times 1.0)^{1/2} = 1.0$
HSI = 0.90

TY's 16 (108.0 acres), 25 (82.7 acres), and 56 (62.0 acres) - same as TY6, HSI = 0.90

3. A. TIDAL EMERGENT MARSH - WITHOUT-PROJECT (PA1)

a) Salt Marsh Rail Guild (USFWS 1995)
TY0 (3.0 acres, outboard of the levee) - Baseline. HSI same as for PA1, Alternative 2 = 0.46

TY's 1, 6, 16, 25, and 56 are all assumed to be equal to baseline conditions, HSI = 0.46

b) Egret Guild (Roberts 1986a)
TY0 (3.0 acres, outboard of the levee) - Baseline. HSI same as PA1, Alternative 2 = 0.26

TY's 1, 6, 16, 25 and 56 are all assumed to be equal to baseline conditions, HSI = 0.26

3. B. TIDAL EMERGENT MARSH - WITH-THE-PROJECT (PA2)

a) Salt Marsh Rail Guild (USFWS 1995)

TY0 (3.0 acres, outboard of the levee) - HSI same as PA1 = 0.46

TY1 (3.0 acres, outboard of the levee) - Site preparation begins; levees not yet breached; no recovery of salt marsh habitat yet on interior of levee yet, HSI = 0.46

TY6 (4.4 acres) - Levees are breached to allow tidal inundation, all dredge material has been placed, and peninsulas are constructed. Minimal salt marsh recovery on the disposal site has occurred.

V1 = 50-100%, SI = 1.0
V2 = area of salt marsh (4.4 acres) divided by entire project area (592.6 acres) = 1%, SI = 0.01
V3 = levee is breached, 100%, SI = 1.0

$$HSI = (1.0 \times 0.01 \times 1.0)^{1/3} = 0.22$$

TY16 (263.8 acres) - Peninsulas have eroded away. Natural recovery is underway, with areas of mid-marsh (cordgrass) growing.

V1 - Same as baseline, SI = 1.0
V2 - Total area of salt marsh (263.8 acres) divided by the entire project area (592.6 acres) = 45%, SI = 0.45
V3 -100%, SI = 1.0

$$HSI = (1.0 \times 0.45 \times 1.0)^{1/3} = 0.77$$

TY25 (379.8 acres) - Mature channel network established; large subtidal slough channels; intertidal marsh fully developed; tidal ponds beginning to develop.

V1 - same as baseline, SI = 1.0
V2 - total area of salt marsh (379.8 acres) divided by entire project area (596.2) = 64%, SI = 0.64
V3 - 100%, SI = 1.0

$$HSI = (1.0 \times 0.64 \times 1.0)^{1/3} = 0.86$$

TY56 (397.2 acres)

V1 - same as baseline, SI = 1.0
V2 - total area of salt marsh (397.2 acres) divided by entire project area (596.2) = 67%, SI = 0.67
V3 - 100%, SI = 1.0

$$HSI = (1.0 \times 0.67 \times 1.0)^{1/3} = 0.88$$

b) Egret Guild (Roberts 1986a)

TY0 (3.0 acres, outboard of the levee) - Same as for PA1, HSI = 0.26

TY1 (3.0 acres, outboard of the levee) - Site preparation begins, levees not yet breached; no recovery of salt marsh habitat yet, inboard of the levee, HSI = 0.26

TY6 (4.4 acres) - Levees breached to allow tidal inundation; all dredge material has been placed and peninsulas are constructed. Minimal salt marsh recovery at the disposal site has occurred.

V1 - salt marsh (4.4 acres) + acres of mudflats (378.8) divided by the entire project area (596.2) = 64%, SI = 0.64
V2 - acres salt marsh (4.4) divided by total of salt marsh (4.4) + mudflats (378.8) = 1%, SI = 0.50
V3 - 100%, SI = 0.10
V4 - 20%, SI = 0.20
V5 - 95%, SI = 0.97

$$HSI = \frac{2[(0.64 \times 0.50)^{1/2} \times 0.10] + 0.20 + 0.97}{5} = 0.26$$

TY16 (263.8 acres) - Peninsulas eroded away. Natural recovery of salt marsh is underway, with areas of mid-marsh (cordgrass) growing.

V1 - Salt marsh (263.8 acres) + mudflats (90.7 acres) divided by entire project area (596.2 acres) = 59%, SI = 0.59
V2 - Salt marsh (263.8 acres) divided by salt marsh (263.8) plus mudflats (90.7 acres) = 74%, SI = 0.74
V3 - Between 100%, SI = 0.10
V4 - 50%, SI = 0.60

V5 - 95%, SI = 0.97

$$HSI = \frac{2[(0.59 \times 0.74)^{1/2} \times .10] + 0.60 + 0.97}{5} = 0.34$$

TY25 (379.8 acres) - Mature channel network established; large subtidal slough channels formed; intertidal marsh fully developed.
V1 - salt marsh (379.8 acres) + mudflats (0 acres) divided by entire project area (596.2 acres) = 64%, SI = 0.64
V2 - salt marsh (379.8 acres) divided by salt marsh + mudflats (379.8 + 0) =100%, SI = 0.10
V3 - 100%, SI = 0.10
V4 - 75-100%, SI = 1.0
V5 - 95%, SI = 0.97

$$HSI = \frac{2[(0.64 \times 0.10)^{1/2} \times .10] + 1.0 + 0.97}{5} = 0.40$$

TY56 (379.8 acres)
V1 - salt marsh (397.2 acres) + mudflats (0 acres) divided by entire project area (596.2 acres) = 67%, SI = 0.67
V2 - salt marsh (397.2 acres) divided by salt marsh + mudflats (397.2 + 0) =100%, SI = 0.10
V3 - 100%, SI = 0.10
V4 - 75-100%, SI = 1.0
V5 - 95%, SI = 0.97

$$HSI = \frac{2[(0.67 \times 0.10)^{1/2} \times .10] + 1.0 + 0.97}{5} = 0.40$$

4. A. <u>TIDAL CHANNELS - WITHOUT-THE-PROJECT</u> (PA1)

a) <u>Juvenile English Sole (Toole *et al.* 1987)</u>
TY0 (0 acres) - Baseline, HSI same as PA1, Alternatives 2, 4 and 5 = 0

TY's 1, 6, 16, 25 and 56 are all assumed to be equal to baseline conditions, HSI = 0

4. B. <u>TIDAL CHANNELS - WITH-THE-PROJECT</u> (PA2)

a) <u>Juvenile English Sole (Toole *et al.* 1987)</u>
TY0 (0 acres) - Same as PA1, HSI = 0

TY1 (0 acres) - Site preparation begins; levees not yet breached; small tidal channels have formed. Same as Alternatives 2, HSI = 0

TY6 (0 acres) - Levees are breached to allow tidal inundation; all dredge material has been placed; peninsulas are constructed.
HSI same as Alternative 2, HSI = 0

TY16 (14.0 acres) - Peninsulas have eroded away. Natural recovery is underway, with areas of mid-marsh (cordgrass) growing.
HSI same as Alternatives 2, 4 and 5 = 0.40

TY25 (14.0 acres) and TY 56 (14.0 acres), HSI same as Alternatives 2, 4 and 5 = 0.30

5. A. <u>MUDFLATS - WITHOUT-THE-PROJECT</u> (PA1)

a) <u>Wintering Shorebird Guild (Roberts 1986b)</u>
TY0 (14.3 acres, outboard of levee) - Baseline. HSI same as PA1, Alternatives 2, 4 and 5 = 0.33

TY's 1, 6, 16, 25 and 56 are all assumed to be equal to baseline conditions, HSI = 0.33

5. B. MUDFLATS - WITH-THE-PROJECT (PA2)

a) Wintering Shorebird Guild (Roberts 1986b)

TY0 (14.3 acres, outboard of the levee) - Baseline. Same as PA1, HSI = 0.33

TY1 (14.3 acres, outboard of the levee) - Site preparation begins; levees not yet breached. HSI = 0.33

TY6 (378.8 acres) - Levees are breached to allow tidal inundation; all dredge material has been placed; peninsulas are constructed; mudflats have begun to form.

V1 - acreage of mudflats (378.8) divided by acreage of entire project area (596.2) = 64%, SI = 0.70

V5 - the distance from the outermost edge of the mudflat site would be located within 400 meters of the edge of the bay, SI = 1.0

V6 - the nearest loafing area would be the created fill, which would be within 400 m, SI = 1.0

V7 - Almost all of the area would be greater than 50 m from any disturbance (95%), SI = 0.95

$$HSI = \frac{2(0.70) + \frac{2(1.0 \times 1.0)^{1/2} + 0.95}{3}}{3} = 0.79$$

TY16 (90.7 acres) - Peninsulas have eroded away; natural recovery is underway.

V1 = acreage of mudflats (90.7) divided by acreage of entire project area (596.2) = 15%, SI = 0.15

V5 - same as TY6, SI = 1.0

V6 - same as TY6, SI = 1.0

V7 - same as TY6, SI = 0.95

$$HSI = \frac{2\,(0.15) + \frac{2(1.0\ .x\ 1.0)^{1/2} + 0.95}{3}}{3} = 0.43$$

TY25 (0 acres) - Mature channel network established; large subtidal slough channels; intertidal marsh fully developed, mudflats have disappeared, HSI = 0

TY56 (0 acres) - Same as TY25, HSI = 0

6. A. TIDAL PONDS - WITHOUT-THE-PROJECT (PA1)

a) Wintering Mallard Model (USFWS 1986)

TY0 (0 acres) - Baseline. HSI = 0

TY's 1, 6, 16, 25 and 56 - Same as baseline, HSI = 0

6. B. TIDAL PONDS - WITH-THE-PROJECT (PA2)

b) Wintering Mallard Model (USFWS 1986)

TY0 (0 acres) - Same as PA1, HSI = 0

TY1 (0 acres) - Same as TY0, HSI = 0

TY6 (0 acres) - Same as TY1, HSI = 0

TY16 (0 acres) - Same as TY6, HSI = 0

TY25 (0 acres) - Same as TY16, HSI = 0

TY56 (3.3 acres) - Ponds have formed.

HSI same as Alternatives 2, 4 and 5 = 1.0

7. A. <u>NON-TIDAL EMERGENT MARSH - WITHOUT-THE-PROJECT</u> (PA1)

a) <u>Wintering Mallard (USFWS 1986)</u>
TY0 (4.1 acres) - Baseline. Same as PA1, Alternatives 2, 4 and 5, HSI = 0.88
TY's 1, 6, 16, 25 and 56, HSI same as TY0 = 0.88

7. B. <u>NON-TIDAL EMERGENT MARSH - WITH-THE-PROJECT</u> (PA2)

a) <u>Wintering Mallard (USFWS 1986)</u>
TY0 (4.1 acres) - HSI same as PA1 = 0.88

TY1 (0 acres) - HSI = 0

TY6 (2.0 acres)
V2 - 100%, SI = 1.0
V3 - water present annually, SI = 1.0
V4 - 0 mi, SI = 1.0
V7 - 50%, SI = 0.80

HSI = 1.0 $(1.0 \times 1.0 \times 0.80)^{1/3}$ = 0.93

TY's 16, 25 and 56, HSI same as TY6 = 0.93

8. A. <u>TIDAL PANNES - WITHOUT-THE-PROJECT</u> (PA1)

a) <u>Wintering Mallard Model (USFWS 1986)</u>
TY0 (0 acres) - Baseline. HSI = 0

TY's 1, 6, 16, 25 and 56, HSI same as baseline = 0

8. B. <u>TIDAL PANNES - WITH-THE-PROJECT</u> (PA2)

a) <u>Wintering Mallard Model (USFWS 1986)</u>

TY0 (0 acres) - HSI same as PA1 = 0

TY1 (0 acres) - HSI same as TY0 = 0

TY6 (33.0 acres) - Pannes have started to form.
V2 - 100% of area is 1-6" deep, SI = 1.0
V3 - water present annually, SI = 1.0
V4 - within 0-1 miles, SI = 0.95
V7 - tidal pannes are typically void of emergent wetland vegetation, therefore 0%, SI = 0.40

HSI = 0.95$(1.0 \times 1.0 \times 0.40)^{1/3}$ 0.70

TY's 16 (33.0 acres), 25 (33.0 acres) and 56 (33.0 acres), HSI same as TY6 = 0.70

9. A. <u>SUBTIDAL - WITHOUT -THE-PROJECT</u> (PA1)

a) <u>Juvenile English Sole (Toole *et al*. 1987)</u>

TY0 (0 acres) - HSI = 0

TY's 1, 6, 16, 25 and 56 same as TY0, HSI = 0

9. B. <u>SUBTIDAL - WITH-THE-PROJECT</u> (PA2)

a) <u>Juvenile English Sole (Toole *et al.* 1987)</u>
TY0 (0 acres) - HSI same as PA1 = 0
TY1 (0 acres) - HSI same as TY0 = 0

TY6 (17.3 acres) - HSI same as Alternatives 2, 4 and 5 = 0.20

TY16 (43.5 acres) - HSI same as Alternatives 2, 4 and 5 = 0.40

TY25 (43.5 acres) - HSI same as Alternatives 2, 4 and 5 = 0.30

TY56 (43.5 acres) - HSI same as Alternatives 2, 4 and 5 = 0.30

<u>Alternative 4, Natural Sedimentation, HAAF and SLCP</u>

1. A. <u>UPLANDS - WITHOUT THE PROJECT</u> (PA1)

a) <u>California Ground Squirrel Model (SCS 1980)</u>
TY0 (492.7 acres) - Baseline. HSI same as for PA1, Alternatives 2, 3 and 5 = 0.21

TY's 1, 2, 6, 16, 27, and 52 are all assumed to be equal to baseline conditions, HSI = 0.21

b) <u>California Vole Model (Garrison 1988)</u>
TY0 (492.7 acres) - Baseline. HSI same as for PA1, Alternatives 2, 3 and 5 = 0.96

TY's 1, 2, 6, 16, 27 and 52 are all assumed to be equal to baseline conditions, HSI = 0.96

c) <u>Western Meadowlark Model (USFWS 1980)</u>
TY0 (492.7 acres) - Baseline. HSI same as for PA1, Alternatives 2, 3 and 5 = 0.85

TY's 1, 2, 6, 16, 27 and 52, same as TY0, HSI = 0.85

1. B. <u>UPLANDS - WITH-THE PROJECT</u> (PA2)

a) <u>California Ground Squirrel Model (SCS 1980)</u>
TY0 (492.7 acres) - HSI same as PA1 = 0.21

TY1 (543.3 acres) - HSI same as Alternatives 2, 3 and 5 = 0

TY2 (179.2 acres) - HSI same as Alternatives 2, 3 and 5 = 0

TY6 (73.5 acres), TY16 (73.5 acres), TY27 (73.5 acres), and TY52 (73.5 acres) - HSI same as Alternatives 2, 3 and 5 = 0.21

b) <u>California Vole Model (Garrison 1988)</u>
TY0 (492.7 acres) - Baseline, same as PA1, HSI = 0.96

TY1 (543.3 acres) - HSI same as Alternatives 2, 3 and 5 = 0

TY2 (179.2 acres) - HSI same as Alternatives 2, 3 and 5 = 0

TY6 (73.5 acres), TY16 (73.5 acres), TY27 (73.5 acres), and TY52 (73.5 acres) - HSI same as Alternatives 2, 3 and 5 = 0.96

c) Western Meadowlark Model (USFWS 1980)
TY0 (492.0 acres) - HSI same as PA1 = 0.85

TY1 - (543.3 acres), HSI same as for Alternatives 2, 3 and 5 = 0

TY2 - (179.2 acres), HSI same as Alternatives 2, 3 and 5 = 0

TY6 (73.5 acres), TY16 (73.5 acres), TY27 (73.5 acres), and TY52 (73.5 acres), HSI same as for Alternatives 2, 3 and 5 = 0.85

2. A. SEASONAL WETLANDS - WITHOUT-THE-PROJECT (PA1)

a) Wintering Mallard Model (USFWS 1986)
TY0 - (48.5 acres) Baseline. HSI same as PA1, Alternatives 2, 3 and 5 = 0.66

TY's 1, 2, 6, 16, 27 and 52 are all assumed to be equal to baseline conditions, HSI = 0.66

b) Desert Cottontail (USFWS 1985)
TY0 - (48.5 acres) Baseline. HSI same as PA1, Alternatives 2, 3 and 5 = 0

TY's 1, 2, 6, 16, 27 and 52 are all assumed to be equal to baseline conditions, HSI = 0

2. B. SEASONAL WETLANDS - WITH-THE-PROJECT (PA2)

a) Wintering Mallard Model (USFWS 1986)
TY0 (48.5 acres) - HSI same as for PA1, HSI = 0.66

TY1 (0 acres) - HSI same as Alternatives 2, 3 and 5 = 0

TY2 (0 acres) - HSI same as Alternatives 2, 3 and 5 = 0

TY6 (43.2 acres), TY16 (43.2 acres), TY27 (43.2) and TY52 (43.2 acres) - HSI same as Alternatives 2, 3 and 5 = 0.95

b) Desert Cottontail (USFWS 1985)
TY0 (48.5 acres) - HSI same as PA1, HSI = 0

TY1 (0 acres) - HSI same as Alternatives 2, 3 and 5 = 0

TY2 (0 acres) - HSI same as Alternatives 2, 3 and 5 = 0

TY6 (43.2 acres), TY16 (43.2 acres), TY27 (43.2 acres), and TY52 (43.2 acres) - HSI same as for Alternatives 2, 3 and 5 = 0.90

3. A. TIDAL EMERGENT MARSH - WITHOUT-THE-PROJECT (PA1)

a) Salt Marsh Rail Guild (USFWS 1995)
TY0 (3.6 acres, outboard of the levee)
V1 - 100%, SI = 1.0
V2 - total acres salt marsh (3.6) divided by entire project area (857.2) = 0%, SI = 0
V3 - 100%, SI = 1.0

$$HSI = (1.0 \times 0 \times 1.0)^{1/3} = 0$$

TY's 1, 2, 6, 16, 27 and 52 are all assumed to be equal to baseline conditions, HSI = 0

b) Egret Guild (Roberts 1986a)
TY0 (3.6 acres, outboard of the levee)

V1 - acres salt marsh (3.6) + acres mudflats (24.7) divided by entire project area (857.2) = 3%, SI = 0.03
V2 - acres salt marsh (3.6) divided by acres salt marsh (3.6) + acres mudflats (24.7) = 13%, SI = 0.65
V3 - 100%, SI = 0.10
V4 - 80-100%, SI = 1.0
V5 - 75%, SI = 0.78

$$HSI = \frac{2[(0.03 \times 0.65)^{½} \times 0.10] + 1.0 + 0.78}{5} = 0.36$$

TY's 1, 2 6, 16, 27 and 52 are all assumed to be equal to baseline conditions, HSI = 0.36

3. B. TIDAL EMERGENT MARSH - WITH-THE-PROJECT (PA2)

a) Salt Marsh Rail Guild (USFWS 1995)
TY0 (3.6 acres, outboard of the levee) - Same as PA1 = 0

TY1 (3.6 acres, outboard of the levee) - HSI same as for Alternative 5 = 0

TY2 (0 acres) - HSI = 0

TY6 (31.1 acres) - Levees are breached to allow tidal inundation, all dredge material has been placed, and peninsulas are constructed. Minimal salt marsh recovery on the disposal site has occurred.

V1 = 50-100%, SI = 1.0
V2 = area of salt marsh (31.1 acres) divided by entire project area (857.2 acres) = 4%, SI = 0.04
V3 = levee is breached, 100%, SI = 1.0

$HSI = (1 \times 0.04 \times 1.0)^{1/3} = 0.34$

TY16 (298.3 acres) - Peninsulas have eroded away. Natural recovery is underway, with areas of mid-marsh (cordgrass) growing.

V1 - Same as baseline, SI = 1.0
V2 - Total area of salt marsh (298.3 acres) divided by the entire project area (857.2 acres) = 35%, SI = 0.35
V3 -100%, SI = 1.0

$HSI = (1.0 \times 0.35 \times 1.0)^{1/3} = 0.70$

TY27 (600.0 acres) - Mature channel network established; large subtidal slough channels; intertidal marsh fully developed; tidal ponds beginning to develop.

V1 - 100%, SI = 1.0
V2 - total area salt marsh (600.0) divided by entire project area (857.2) = 70%, SI = 0.70
V3 - 100%, SI = 1.0

$HSI = (1.0 \times 0.70 \times 1.0)^{1/3} = 0.89$

TY52 (596.7 acres).

V1 - 100%, SI = 1.0
V2 - total area of salt marsh (596.7 acres) divided by entire project area (857.2) = 70%, SI = 0.70
V3 - 100%, SI = 1.0

$HSI = (1.0 \times 0.70 \times 1.0) = 0.89$

b) Egret Guild (Roberts 1986a)
TY0 (3.6 acres, outboard of the levee) - Same as for PA1, HSI = 0.36

TY1 (3.6 acres, outboard of the levee) - Site preparation begins, levees not yet breached. No recovery of salt marsh habitat yet, inboard of the levee, HSI = 0.36

TY2 (0 acres) - HSI = 0

TY6 (31.1 acres) - Levees breached to allow tidal inundation; all dredge material has been placed and peninsulas are constructed. Minimal salt marsh recovery at the disposal site has occurred.

V1 - salt marsh (31.1 acres) + acres of mudflats (580.4) divided by the entire project area (857.2) = 71%, SI = 0.71
V2 - acres salt marsh (31.1) divided by total of salt marsh (31.1) + mudflats (580.4) = 5%, SI = 0.55
V3 - 100%, SI = 0.10
V4 - 33%, SI = 0.38
V5 - 95%, SI = 0.97

$$HSI = \frac{2[(0.71 \times 0.55)^{1/2} \times 0.10] + 0.38 + 0.97}{5} = 0.29$$

TY16 (298.3 acres) - Peninsulas eroded away. Natural recovery of salt marsh is underway, with areas of mid-marsh (cordgrass) growing.

V1 - Salt marsh (298.3 acres) + mudflats (301.7 acres) divided by entire project area (857.2 acres) = 70%. SI = 0.70
V2 - Salt marsh (298.3 acres) divided by salt marsh (298.3) plus mudflats (301.7 acres) = 50%, SI = 1.0
V3 - Between 100%, SI = 0.10
V4 - Between 75-100%, SI = 1.0
V5 - 95%, SI = 0.97

$$HSI = \frac{2[(0.70 \times 1.0)^{1/2} \times .10] +1.0 + 0.97}{5} = 0.43$$

TY27 (600.0 acres) - Mature channel network established; large subtidal slough channels formed; intertidal marsh fully developed.

V1 - salt marsh (600.0 acres) + mudflats (0 acres) divided by entire project area (857.2 acres) = 70%, SI = 0.70
V2 - salt marsh (600.0 acres) divided by salt marsh + mudflats (600.0 + 0) =100%, SI = 0.10
V3 - 100%, SI = 1.0
V4 - 75-100%, SI = 1.0
V5 - 95%, SI = 0.97

$$HSI = \frac{2[(0.70 \times 0.10)^{1/2} \times 1.0] + 1.0 + 0.97}{5} = 0.40$$

TY52 (596.7 acres)

V1 - salt marsh (596.7 acres) + mudflats (0 acres) divided by entire project area (857.2 acres) = 70%, SI = 0.70
V2 - salt marsh (596.7 acres) divided by salt marsh + mudflats (596.7 + 0) =100%, SI = 0.10
V3 - 100%, SI = 1.0
V4 - 75-100%, SI = 1.0
V5 - 95%, SI = 0.97

$$HSI = \frac{2[(0.70 \times 0.10)^{1/2} \times .1.0] + 1.0 + 0.97}{5} = 0.40$$

4. A. <u>TIDAL CHANNELS - WITHOUT-THE-PROJECT</u> (PA1)

a) <u>Juvenile English Sole (Toole *et al.* 1987)</u>

TY0 (0 acres) - Baseline. HSI same as for PA1, Alternatives 2, 3 and 5 = 0

TY’s 1, 2, 6, 16, 27 and 52 are all assumed to be equal to baseline conditions, HSI = 0

4. B. <u>TIDAL CHANNELS - WITH-THE-PROJECT</u> (PA2)

a) <u>Juvenile English Sole (Toole *et al.* 1987)</u>

TY0 (0 acres) - Same as PA1, HSI = 0

TY1 (0 acres) - HSI same Alternatives 2, 3 and 5 = 0

TY2 (0 acres) - HSI same as TY1 = 0

TY6 (7.0 acres) - HSI same as Alternatives 2, 3 and 5 = 0.20

TY16 (14.0 acres) - HSI same as Alternatives 2, 3 and 5 = 0.40

TY27 (14.0 acres) - HSI same as Alternatives 2, 3 and 5 = 0.30

TY52 (14.0 acres) - HSI same as Alternatives 2, 3 and 5 = 0.30

5. A. <u>MUDFLATS - WITHOUT-THE-PROJECT</u> (PA1)

a) <u>Wintering Shorebird Guild (Roberts 1986b)</u>

TY0 (24.7 acres, outboard of levee) - Baseline.

V1 - acres mudflats (24.7) divided by entire project area (857.2) = 3%, SI = 0.03
V5 - within 400 m, SI = 1.0
V6 - within 400 m, SI = 1.0
V7 - 100%, SI = 1.0

$$HSI = \frac{2(0.03) + \frac{2(1.0 \times 1.0)^{1/2} + 1.0}{3}}{3} = 0.35$$

TY's 1, 2, 6, 16, 27 and 52 are all assumed to be equal to baseline conditions, HSI = 0.35

5. B. <u>MUDFLATS - WITH-THE-PROJECT</u> (PA2)

a) <u>Wintering Shorebird Guild (Roberts 1986b)</u>

TY0 (24.7 acres, outboard of the levee) - Baseline, same as PA1, HSI = 0.35

TY1 (24.7 acres, outboard of the levee) - HSI same as for Alternative 2 = 0.35

TY2 (115.0) - Levees are breached to allow tidal inundation; peninsulas are constructed; mudflats begin to form.

V1 - acreage of mudflats (115.0) divided by entire project area (857.2) = 13%, SI = 0.13
V5 - the distance from the outermost edge of the mudflat site would be located within 400 meters of the edge of the bay, SI = 1.0
V6 - loafing sites are generally located near the bay margin; would be within 400 m, SI = 1.0
V7 - Almost all of the area would be greater than 50 m from any disturbance (95%), SI = 0.95

$$HSI = \frac{2(0.13) + \frac{2(1.0) \times 1.0)^{1/2} + 0.95}{3}}{3} = 0.41$$

TY6 (580.4 acres)

V1 - acreage of mudflat (580.4) divided by acreage of entire project area (857.2) = 68%. SI = 0.72
V5 - the distance from the outermost edge of the mudflat site would be located within 400 meters of the edge of the bay, SI = 1.0
V6 - loafing sites are generally located near the bay margin; would be within 400 m, SI = 1.0
V7 - Almost all of the area would be greater than 50 m from any disturbance (95%), SI = 0.95

$$HSI = \frac{2(0.72) + \frac{2(1.0) \times 1.0)^{1/2} + 0.95}{3}}{3} = 0.81$$

TY16 (301.7 acres) - Peninsulas have eroded away. Natural recovery is underway.

V1 - acreage of mudflat (301.7) divided by acreage of entire project area (857.2) = 35%, SI = 0.40
V5 - same as TY6, SI = 1.0
V6 - same as TY6, SI = 1.0
V7 - same as TY6, SI = 0.95

$$HSI = \frac{2\,(0.40) + \dfrac{2(1.0\ .x\ 1.0)^{1/2} + 0.95}{3}}{3} = 0.59$$

TY's 27 (0 acres) - Mature channel network established; large subtidal slough channels; intertidal marsh fully developed, mudflats have disappeared, HSI = 0

TY52 (0 acres) - HSI same as TY27 = 0

6. A. <u>TIDAL PONDS - WITHOUT-THE-PROJECT</u> (PA1)

a) <u>Wintering Mallard Model (USFWS 1986)</u>
TY0 (0 acres) - Baseline. HSI = 0

TY's 1, 2, 6, 16, 27 and 52 - same as baseline, HSI = 0

6. <u>TIDAL PONDS - WITH-THE-PROJECT</u> (PA2)

a) <u>Wintering Mallard Model (USFWS 1986)</u>
TY0 (0 acres) - Same as PA1, HSI = 0

TY1 (0 acres) - HSI same as Alternative 2 = 0

TY2 (0 acres) - HSI same as Alternative 2 = 0

TY6 (0 acres) - HSI same as Alternative 2 = 0

TY16 (0 acres) - HSI same as Alternative 2 = 0

TY27 (0 acres) - HSI same as Alternative 2 = 0

TY52 (3.3 acres) - HSI same as Alternative 2 = 1.0

7. A. <u>NON-TIDAL EMERGENT MARSH - WITHOUT-THE-PROJECT</u> (PA1)

a) <u>Wintering Mallard (USFWS 1986)</u>
TY0 (4.1 acres) - Baseline. HSI same as Alternatives 2, 3 and 5 = 0.88

TY's 1, 2, 6, 16, 27 and 52, HSI same as TY0 = 0.88

7. B. <u>NON-TIDAL EMERGENT MARSH - WITH-THE-PROJECT</u> (PA2)

a) <u>Wintering Mallard (USFWS 1986)</u>
TY0 (4.1 acres) - HSI same as PA1 = 0.88

TY1 (0 acres) - HSI = 0

TY2 (0 acres) - HSI = 0

TY’s 6, 16, 27 and 52 (all 64.5 acres) - HSI same as Alternatives 2, 3 and 5 = 0.93

8. A. <u>SUBTIDAL - WITHOUT-THE-PROJECT</u> (PA1)

a) <u>Juvenile English Sole (Toole *et al*. 1987)</u>
TY0 (0 acres) - HSI = 0

TY’s 1, 2, 6, 16, 27, and 52 - HSI same as TY0 = 0

8. B. <u>SUBTIDAL - WITH-THE-PROJECT</u> (PA2)

a) <u>Juvenile English Sole (Toole *et al.* 1987)</u>
TY0 (0 acres) - Same as PA1, HSI = 0

TY1 (0 acres) - Same as TY0, HSI = 0

TY2 (561.1 acres) - Same as Alternative 2, HSI = 0.20

TY6 (54.5 acres) - Same as Alternatives 2, 3 and 5, HSI = 0.20

TY16 (54.5 acres) - Same as Alternatives 2, 3 and 5, HSI = 0.40

TY27 (54.5 acres) and TY52 (54.5 acres) - Same as Alternatives 2, 3 and 5, HSI = 0.30

<u>Alternative 5, Natural Gradient with Dredged Material, HAAF and SLCP</u>

1. A. <u>UPLANDS - WITHOUT-THE-PROJECT</u> (PA1)

a) <u>California Ground Squirrel Model (SCS 1980)</u>
TY0 (492.7 acres) - Baseline, HSI same as PA1, Alternatives 2, 3 and 4 = 0.21

TY’s 1, 6, 16, 25 and 56 are all assumed to be equal to baseline conditions, HSI = 0.21

b) <u>California Vole Model (Garrison 1988)</u>
TY0 (492.7 acres) - Baseline, HSI same as PA1, Alternatives 2, 3 and 4 = 0.96

TY’s 1, 6, 16, 25 and 56 are all assumed to be equal to baseline conditions, thus, HSI = 0.96

c) <u>Western Meadowlark Model (USFWS 1980)</u>
TY0 (492.7 acres) - Baseline, HSI same as PA1 Alternatives 2, 3 and 4 = 0.85

TY’s 1, 6, 16, 25 and 56, same as TY0, HSI = 0.85

1. A. <u>UPLANDS - WITH-THE PROJECT</u> (PA2)

a) <u>California Ground Squirrel Model (SCS 1980)</u>
TY0 (492.7 acres) - HSI same as PA1 = 0.21

TY1 (543.3 acres) - Area is graded over, HSI = 0

TY6 (84.7 acres), TY16 (84.7 acres), TY25 (84.7 acres), and TY56 (84.7 acres) - Only levees remain as upland habitat. HSI same as TY0 = 0.21

b) <u>California Vole Model (Garrison 1988)</u>

TY0 (492.7 acres) - Baseline. Same as PA1, HSI = 0.96

TY1 (543.3 acres) - Site preparation begins, area is now subtidal, no upland values, HSI = 0

TY6 (84.7 acres) - All dredge material has been placed; peninsulas are constructed; levees are breached; levees remain as the only upland habitat. HSI same as TY0 = 0.96

TY16 (84.7 acres), TY25 (84.7 acres), and TY56 (84.7 acres) - HSI same as TY6 = 0.96

c) Western Meadowlark Model (USFWS 1980)
TY0 (492.7 acres) - HSI same as PA1 = 0.85

TY1 (543.3 acres) - Site preparation begins, and area is graded over, HSI = 0

TY6 (84.7 acres) - All dredge material has been placed; peninsulas are constructed; levees are breached; levees remain as the only upland habitat. HSI same as TY0 = 0.85

TY16 (84.7 acres), TY25 (84.7 acres), and TY56 (84.7 acres) - HSI same as TY6 = 0.85

2. A. SEASONAL WETLANDS - WITHOUT-THE-PROJECT (PA1)

a) Wintering Mallard Model (USFWS 1986)
TY0 (48.5 acres) - Baseline. HSI same as PA1, Alternatives 2, 3 and 4 = 0.66

TY's 1, 6, 16, 25 and 56 are all assumed to be equal to baseline conditions - HSI = 0.66

2. Desert Cottontail (USFWS 1985)
TY0 (48.5 acres) - Baseline.   HSI same as for PA1, Alternatives 2, 3 and 4 = 0

TY's 1, 6, 16, 25 and 56 are all assumed to be equal to baseline conditions - HSI = 0

2. B. SEASONAL WETLANDS - WITH-THE-PROJECT (PA2)

a) Wintering Mallard Model (USFWS 1986)
TY0 (48.5 acres) - Baseline, same as for PA1, HSI = 0.66

TY1 (0 acres) - Area is graded over, no seasonal wetlands, HSI = 0

TY6 (119.5 acres) - Levee is breached and all dredge material has been placed. The area would be intensively managed to recover seasonal wetland values. Management actions would consist of: grading the entire wetland sites; constructing depressions on the land to pond water; actively pumping water on to the site; excavating ditches to hold water throughout the year; and planting emergent vegetation along the edges.
HSI same as Alternatives 2, 3 and 4 = 0.95

TY16 (108.0 acres), 25 (82.7 acres) and 56 (62.0 acres) would be the same as TY6, HSI = 0.95

b) Desert Cottontail (USFWS 1985)
TY0 (48.5 acres) - Baseline, same as PA1, HSI = 0

TY1 (0 acres) - Site preparation begins, and existing wetlands are graded over, HSI = 0

TY6 (119.5 acres) - Vegetation has become well-established
HSI same as Alternatives 2, 3 and 4 = 0.90

TY16 (108.0 acres), TY25 (82.7 acres) and TY56 (62.0 acres) HSI same as TY6 = 0.90

3. A. TIDAL EMERGENT MARSH - WITHOUT-PROJECT (PA1)

a) Salt Marsh Rail Guild (USFWS 1995)
TY0 (3.6 acres, outboard of the levee) - Baseline. HSI same as for PA1, Alternative 4 = 0

TY's 1, 6, 16, 25 and 56 are all assumed to be equal to baseline conditions, HSI = 0

b) Egret Guild (Roberts 1986a)
TY0 (3.6 acres, outboard of the levee) - Baseline. HSI same as PA1, Alternative 4 = 0.36

TY's 1, 6, 16, 25 and 56 are all assumed to be equal to baseline conditions, HSI = 0.36

3. B. TIDAL EMERGENT MARSH - WITH-THE-PROJECT (PA2)

a) Salt Marsh Rail Guild (USFWS 1995)
TY0 (3.6 acres, outboard of the levee) - HSI same as PA1 = 0

TY1 (3.6 acres, outboard of the levee) - Site preparation begins; levees not yet breached; no recovery of salt marsh habitat yet on interior of levee yet, HSI = 0

TY6 (6.5 acres) - Levees are breached to allow tidal inundation, all dredge material has been placed, and peninsulas are constructed. Minimal salt marsh recovery on the disposal site has occurred.

V1 = 50-100%, SI = 1.0
V2 = area of salt marsh (6.5 acres) divided by entire project area (857.2 acres) = 1%, SI = 0.01
V3 = levee is breached, 100%, SI = 1.0

HSI = $(1.0 \times 0.01 \times 1.0)^{1/3} = 0.22$

TY16 (397.2 acres) - Peninsulas have eroded away. Natural recovery is underway, with areas of mid-marsh (cordgrass) growing.

V1 - Same as TY6, SI = 1.0
V2 - Total area of salt marsh (397.2 acres) divided by the entire project area (857.2 acres) = 46%, SI = 0.46
V3 - 100%, SI = 1.0

HSI = $(1.0 \times 0.46 \times 1.0)^{1/3} = 0.77$

TY25 (571.3 acres) - Mature channel network established; large subtidal slough channels; intertidal marsh fully developed; tidal ponds beginning to develop.

V1 - same as TY16, SI = 1.0
V2 - Area of salt marsh (571.3 acres) divided by the entire project area (857.2 acres) = 67%, SI = 0.67
V3 - 100%, SI = 1.0

HSI = $(1.0 \times 0.67 \times 1.0)^{1/3} = 0.88$

TY56 (588.7 acres)

V1 - same as baseline, SI = 1.0
V2 - total area of salt marsh (588.7 acres) divided by entire project area (857.2) = 69%, SI = 0.69
V3 - 100%, SI = 1.0

HSI = $(1.0 \times 0.69 \times 1.0) = 0.88$

b) Egret Guild (Roberts 1986a)
TY0 (4.1 acres, outboard of the levee) - Same as for PA1, HSI = 0.36

TY1 (3.6 acres, outboard of the levee) - Site preparation begins, levees not yet breached; no recovery of salt marsh habitat yet, inboard of the levee, HSI = 0.36

TY6 (6.5 acres) - Levees breached to allow tidal inundation; all dredge material has been placed and peninsulas are constructed. Minimal salt marsh recovery at the disposal site has occurred.

V1 - acres salt marsh (6.5) + acres of mudflats (575.7) divided by the entire project area (857.2) = 68%, SI = 0.68
V2 - acres salt marsh (6.5) divided by total area of salt marsh (6.5) + mudflats (575.7) = 1%, SI = 0.50
V3 - 100%, SI = 0.10
V4 - 20%, SI = 0.20
V5 - 95%, SI = 0.97

$$HSI = \frac{2[(0.68 \text{ x } 0.50)^{1/2} \text{ x } 0.10] + 0.20 + 0.97}{5} = 0.26$$

TY16 (397.2 acres) - Peninsulas eroded away. Natural recovery of salt marsh is underway, with areas of mid-marsh (cordgrass) growing.
V1 - Salt marsh (397.2 acres) + mudflats (148.8 acres) divided by entire project area (857.2 acres) = 64%. SI = 0.64
V2 - Salt marsh (397.2 acres) divided by salt marsh (397.2) plus mudflats (148.8 acres) = 73%. SI = 0.73
V3 - Between 100%, SI = 0.10
V4 - 50%, SI = 0.60
V5 - 95%, SI = 0.97

$$HSI = \frac{2[(0.64 \text{ x } 0.73)^{1/2} \text{ x } .10] + 0.60 + 0.97}{5} = 0.34$$

TY25 (571.3 acres) - Mature channel network established; large subtidal slough channels formed; intertidal marsh fully developed.
V1 - salt marsh (571.3 acres) + mudflats (0 acres) divided by entire project area (857.2 acres) = 67%, SI = 0.67
V2 - salt marsh (571.3 acres) divided by salt marsh + mudflats (571.3 + 0) =100%, SI = 0.10
V3 - 100%, SI = 0.10
V4 - 75-100%, SI = 1.0
V5 - 95%, SI = 0.97

$$HSI = \frac{2[(0.67 \text{ x } 0.10)^{1/2} \text{ x } .10] + 1.0 + 0.97}{5} = 0.40$$

TY56 (588.7 acres)
V1 - salt marsh (588.7 acres) + mudflats (0 acres) divided by entire project area (857.2 acres) = 69%, SI = 0.69
V2 - salt marsh (588.7 acres) divided by salt marsh + mudflats (588.7 + 0) =100%, SI = 0.10
V3 - 100%, SI = 0.10
V4 - 75-100%, SI = 1.0
V5 - 95%, SI = 0.97

$$HSI = \frac{2[(0.69 \text{ x } 0.10)^{1/2} \text{ x } .10] + 1.0 + 0.97}{5} = 0.40$$

4. A. <u>TIDAL CHANNELS - WITHOUT-THE-PROJECT</u> (PA1)

a) <u>Juvenile English Sole (Toole *et al.* 1987)</u>
TY0 (0 acres) - Baseline, HSI same as PA1, Alternatives 2, 3 and 4 = 0

TY’s 1, 6, 16, 25 and 56 are all assumed to be equal to baseline conditions - HSI = 0

4. B. <u>TIDAL CHANNELS - WITH-THE-PROJECT</u> (PA2)

a) <u>Juvenile English Sole (Toole *et al.* 1987)</u>
TY0 (0 acres) - Same as PA1, HSI = 0

TY1 (0 acres) - HSI same as Alternatives 2, 3 and 4 = 0

TY6 (0 acres) - HSI same as TY1 = 0

TY16 (21.5 acres) - HSI same as Alternatives 2, 3 and 4 = 0.40

TY25 (21.5 acres) and TY56 (21.5 acres), HSI same as Alternatives 2, 3 and 4 = 0.30

5. A. <u>MUDFLATS - WITHOUT-THE-PROJECT</u> (PA1)

a) <u>Wintering Shorebird Guild (Roberts 1986b)</u>
TY0 (24.7 acres, outboard of levee) - Baseline. HSI same as PA1, Alternative 4 = 0.35

TY's 1, 6, 16, 25 and 56 are all assumed to be equal to baseline conditions, HSI = 0.35

5. B. <u>MUDFLATS - WITH-THE-PROJECT</u> (PA2)

a) <u>Wintering Shorebird Guild (Roberts 1986b)</u>
TY0 (24.7 acres, outboard of the levee) - Baseline. HSI same as PA1, = 0.35

TY1 (24.7 acres, outboard of the levee) - Site preparation begins; levees not yet breached. HSI = 0.35

TY6 (575.7 acres) - Levees are breached to allow tidal inundation; all dredge material has been placed; peninsulas are constructed.

V1 - acreage of mudflat (575.7) divided by acreage of entire project area (857.2) = 67%. SI = 0.77
V5 -the distance from the outermost edge of the mudflat site would be located within 400 meters of the edge of the bay, SI = 1.0
V6 - the nearest loafing area would be the created fill, which would be within 400 m, SI = 1.0
V7 - Almost all of the area would be greater than 50 m from any disturbance (95%), SI = 0.95

$$HSI = \frac{2(0.77) + \frac{2(1.0 \times 1.0)^{1/2} + 0.95}{3}}{3} = 0.84$$

TY16 (148.8 acres) - Peninsulas have eroded away. Natural recovery is underway.

V1 - acreage of mudflat (148.8) divided by acreage of entire project area (857.2) = 17%, SI = 0.17
V5 - same as TY6, SI = 1.0
V6 - same as TY6, SI = 1.0
V7 - same as TY6, SI = 0.95

$$HSI = \frac{2\,(0.17) + \frac{2(1.0\ .x\ 1.0)^{1/2} + 0.95}{3}}{3} = 0.44$$

TY25 (0 acres) - Mature channel network established; large subtidal slough channels; intertidal marsh fully developed, mudflats have disappeared, HSI = 0

TY56 (0 acres) - HSI same as TY25 = 0

6. A. <u>TIDAL PONDS - WITHOUT-THE-PROJECT</u> (PA1)

a) <u>Wintering Mallard Model (USFWS 1986)</u>
TY0 (0 acres) - Baseline. HSI = 0

TY's 1, 6, 16, 56 - same as baseline, HSI = 0

6. B. <u>TIDAL PONDS - WITH-THE-PROJECT</u> (PA2)

a) Wintering Mallard Model (USFWS 1986)
TY0 (0 acres) - Same as PA1, HSI = 0

TY1 (0 acres) - Same as TY0, HSI = 0

TY6 (0 acres) - Same as TY1, HSI = 0

TY16 (0 acres) - Same as TY6, HSI = 0

TY25 (0 acres) - Same as TY16, HSI = 0

TY56 (3.3 acres) - Ponds have formed.

HSI same as Alternatives 2, 3 and 4 = 1.0

7. A. NON-TIDAL EMERGENT MARSH - WITHOUT-THE-PROJECT (PA1)

a) Wintering Mallard (USFWS 1986)
TY0 (4.1 acres) Baseline. HSI same as PA1, Alternatives 2, 3 and 4 = 0.88

TY's 1, 6, 16, 25 and 56, HSI same as TY0 = 0.88

7. B. NON-TIDAL EMERGENT MARSH - WITH-THE-PROJECT (PA2)

a) Wintering Mallard (USFWS 1986)
TY0 (4.1 acres) - HSI same as PA1 = 0.88

TY1 (0 acres) - HSI same as Alternatives 2, 3 and 4 = 0.93

TY's 16, 25 and 56, HSI same as Alternatives 2, 3 and 4 = 0.93

8. A. TIDAL PANNES - WITHOUT-THE-PROJECT (PA1)

a) Wintering Mallard Model (USFWS 1986)
TY0 (0 acres) - Baseline. HSI = 0

TY's 1, 6, 16, 25 and 56, HSI same as baseline = 0

8. B. TIDAL PANNES - WITH-THE-PROJECT (PA2)

a) Wintering Mallard Model (USFWS 1986)
TY0 (0 acres) - HSI same as PA1 = 0

TY1 (0 acres) - HSI same as TY0 = 0

TY6 (40.5 acres), TY16 (40.5 acres), TY25 (40.5 acres), and TY56 (40.5 acres) - HSI same as Alternative 3 = 0.70

9. A. SUBTIDAL - WITHOUT-THE-PROJECT (PA1)

a) Juvenile English Sole Model (Toole *et al.* 1987)

TY0 (0 acres) - Baseline. HSI = 0

TY's 1, 6, 16, 25 and 56 same as TY0, HSI = 0

9. B. <u>SUBTIDAL - WITH-THE-PROJECT</u> (PA2)

a) <u>Juvenile English Sole Model (Toole *et al.* 1987)</u>

TY0 (0 acres) - HSI same as PA1 = 0

TY1 (0 acres) - HSI same as TY0 = 0

TY6 (28.3 acres) - HSI same as Alternative 3 = 0.20

TY16 (54.5 acres) - HSI same as Alternative 3 = 0.40

TY25 (54.5 acres) and TY56 (54.5 acres) - HSI same as Alternative 3 = 0.30

RESULTS AND DISCUSSION

The project would impact about 3.0 acres of tidal emergent marsh, 32.5 acres of seasonal wetlands, 258.7 acres of uplands, 14.3 acres of mudflats (outboard of the levee), 4.1 acres of non-tidal emergent marsh, and 283.6 acres of developed areas. The tidal restoration project is intended to restore tidal marsh vegetation to the area. Seasonal wetlands and non-tidal emergent marsh would be replaced in-kind, however, tidal emergent marsh, tidal channels, subtidal habitat (temporary), tidal ponds, tidal pannes, and mudflats (temporary) would replace the uplands and developed areas. Uplands are more common in the region, and have a mitigation planning goal of "no net loss of habitat value while minimizing loss of in-kind habitat value" (Resource Category 3) and "minimize loss of habitat value" (Resource Category 4). Any surplus habitat value from tidal restoration could be applied to compensate losses of these uplands.

Acreages and HSIs for each alternative for without- and with-the-project conditions are shown in Tables B-2 through B-5. A summary of changes in habitat area (acres) and value (AAHUs) for each cover-type for each alternative is shown in Tables B-6 through B-9. The HEP analyzed the four alternatives separately. The results are as follows:

<u>Alternative 2, Natural Sedimentation with Cross-levee, HAAF</u>. The new acreages and cover-types that would be created with the project by TY 52 are: 392.2 acres of tidal emergent marsh, 10.7 acres of seasonal wetlands, 14.0 acres of tidal channels, 43.5 of subtidal habitat, 3.3 acres of tidal ponds, and 60.4 acres of non-tidal emergent marsh. There would be a loss 222.9 acres of uplands. Also, mudflats would be created with the project, but lost at the end of the life of the project. Results of the HEP indicate there would be 1) a gain of 117.68 AAHUs with the egret guild and a gain of 234.05 AAHUs with the salt marsh rail guild for the tidal emergent marsh cover-type; 2) a gain of 36.81 AAHUs with the desert cottontail model and a gain of 16.69 AAHUs with the wintering mallard model for the seasonal wetlands cover-type; 3) a loss of 221.35 AAHUs with the California vole model, a loss of 48.42 AAHUs with the California ground squirrel model, and a loss of 195.98 AAHUs with the western meadowlark model for the uplands cover-type; 4) a gain of 3.87 AAHUs with the juvenile English sole model for the tidal channels cover-type; 5) a gain of 16.34 AAHUs with the juvenile English sole model subtidal cover-type; 6) a gain of 54.97 AAHUs with the wintering shorebird guild for the mudflats cover-type; 7) a gain of 0.55 AAHUs with the wintering mallard model for the tidal ponds cover-type; and 8) a gain of 53.06 AAHUs with the wintering mallard model for the non-tidal emergent marsh cover-type.

It was assumed that the 1) egret guild and saltmarsh rail guild (for tidal emergent marsh); 2) desert cottontail and wintering mallard models (for seasonal wetlands); and 3) California vole, California ground squirrel, and western meadowlark models (for uplands) each have equal value in comparing their importance to each cover-type. Consequently, an average AAHU value was calculated for each cover-type at the end of the period of analysis. The average AAHUs are: 1) +175.87 for tidal emergent marsh, +26.75 for seasonal wetlands; -155.25 for uplands; +3.87 for tidal channels; +16.34 for subtidal habitat; +54.97 for mudflats; +0.55 for tidal ponds; and +53.06 for non-tidal emergent marsh. The total AAHU gains are 331.41 and losses are 155.25.

Table B-2. HSIs and acreages for the cover-types for all target years for future conditions without the project (TY0) and future conditions with the project (TY's 1-52) for Alternative 2 for the Hamilton Army Airfield Wetland Restoration Project.

SPECIES MODEL & COVER-TYPE	TY0		TY1		TY2		TY6		TY16		TY27		TY52	
	AREA	HSI	AREA	HSI	AREA	HSI	AREA	HSI	AREA	HSI	AREA	HSI	AREA	HSI
California vole/uplands	258.7	0.96	293.3	0	141.5	0	35.8	0.96	35.8	0.96	35.8	0.96	35.8	0.96
California ground squirrel/uplands	258.7	0.21	293.3	0	141.5	0	35.8	0.21	35.8	0.21	35.8	0.21	35.8	0.21
Western meadowlark/ uplands	258.7	0.85	293.3	0	141.5	0	35.8	0.85	35.8	0.85	35.8	0.85	35.8	0.85
Desert cottontail/ seasonal wetlands	32.5	0	0	0	0	0	43.2	0.90	43.2	0.90	43.2	0.90	43.2	0.90
Wintering mallard/ seasonal wetlands	32.5	0.66	0	0	0	0	43.2	0.95	43.2	0.95	43.2	0.95	43.2	0.95
Wintering mallard/ non-tidal emergent marsh	4.1	0.88	0	0	0	0	64.5	0.93	64.5	0.93	64.5	0.93	64.5	0.95
Salt marsh rail guild/ tidal salt marsh	3.0	0.46	3.0	0.46	0	0	20.4	0.31	196.4	0.69	395.2	0.87	395.2	0.87
Egret guild/tidal salt marsh	3.0	0.26	3.0	0.26	0	0	20.4	0.28	196.4	0.42	395.2	0.42	395.2	0.42
Juvenile English sole/ tidal channels	0	0	0	0	0	0	7.0	0.20	14.0	0.40	14.0	0.30	14.0	0.30
Juvenile English sole/ subtidal habitat	0	0	0	0	375.7	0.20	43.5	0.20	43.5	0.40	43.5	0.30	43.5	0.30
Wintering shorebird guild/mudflats	14.3	0.33	14.3	0.33	77.0	0.41	381.8	0.79	198.8	0.55	0	0	0	0
Wintering mallard/ tidal ponds	0	0	0	0	0	0	0	0	0	0	0	0	3.3	1.0

Table B-3. HSIs and acreages for the cover-types for all target years for future conditions without the project (TY0) and future conditions with the project (TY's 1-56) for Alternative 3 for the Hamilton Army Airfield Wetland Restoration Project.

SPECIES MODEL & COVER-TYPE	TY0		TY1		TY6		TY16		TY25		TY56	
	AREA	HSI	AREA	HSI	AREA	HSI	AREA	HSI	AREA	HSI	AREA	HSI
California vole/uplands	258.7	0.96	293.3	0	41.2	0.96	41.2	0.96	41.2	0.96	41.2	0.96
California ground squirrel/uplands	258.7	0.21	293.3	0	41.2	0.21	41.2	0.21	41.2	0.21	41.2	0.21
Western meadowlark/ uplands	258.7	0.85	293.3	0	41.2	0.85	41.2	0.85	41.2	0.85	41.2	0.85
Desert cottontail/ seasonal wetlands	32.5	0	0	0	119.5	0.90	108.0	0.90	82.7	0.90	62.0	0.90
Wintering mallard/ seasonal wetlands	32.5	0.66	0	0	119.5	0.95	108.0	0.95	82.7	0.95	62.0	0.95
Wintering mallard/ non-tidal emergent marsh	4.1	0.88	0	0	2.0	0.93	2.0	0.93	2.0	0.93	2.0	0.95
Salt marsh rail guild/ tidal salt marsh	3.0	0.46	3.0	0.46	4.4	0.22	263.8	0.77	379.8	0.86	397.2	0.88
Egret guild/tidal salt marsh	3.0	0.26	3.0	0.26	4.4	0.26	263.8	0.34	379.8	0.40	397.2	0.40
Juvenile English sole/ tidal channels	0	0	0	0	0	0	14.0	0.40	14.0	0.30	14.0	0.30
Juvenile English sole/ subtidal habitat	0	0	0	0	17.3	0.20	43.5	0.40	43.5	0.30	43.5	0.30
Wintering mallard/ tidal pannes	0	0	0	0	33.0	0.70	33.0	0.70	33.0	0.70	33.0	0.70
Wintering shorebird guild/mudflats	14.3	0.33	14.3	0.33	378.8	0.79	90.7	0.43	0	0	0	0
Wintering mallard/ tidal	0	0	0	0	0	0	0	0	0	0	3.3	1.0

ponds												

Table B-4. HSIs and acreages for the cover-types for all target years for future conditions without the project (TY0) and future conditions with the project (TY's 1-52) for Alternative 4 for the Hamilton Army Airfield Wetland Restoration Project.

SPECIES MODEL & COVER-TYPE	TY0		TY1		TY2		TY6		TY16		TY27		TY52	
	AREA	HSI	AREA	HSI	AREA	HSI	AREA	HSI	AREA	HSI	AREA	HSI	AREA	HSI
California vole/uplands	492.7	0.96	543.3	0	179.2	0	73.5	0.96	73.5	0.96	73.5	0.96	73.5	0.96
California ground squirrel/uplands	492.7	0.21	543.3	0	179.2	0	73.5	0.21	73.5	0.21	73.5	0.21	73.5	0.21
Western meadowlark/ uplands	492.7	0.85	543.3	0	179.2	0	73.5	0.85	73.5	0.85	73.5	0.85	73.5	0.85
Desert cottontail/ seasonal wetlands	48.5	0	0	0	0	0	43.2	0.90	43.2	0.90	43.2	0.90	43.2	0.90
Wintering mallard/ seasonal wetlands	48.5	0.66	0	0	0	0	43.2	0.95	43.2	0.95	43.2	0.95	43.2	0.95
Wintering mallard/ non-tidal emergent marsh	4.1	0.88	0	0	0	0	64.5	0.93	64.5	0.93	64.5	0.93	64.5	0.95
Salt marsh rail guild/ tidal salt marsh	3.6	0	3.6	0	0	0	31.1	0.34	298.3	0.70	600.0	0.89	596.7	0.89
Egret guild/tidal salt marsh	3.6	0.36	3.6	0	0	0	31.1	0.29	298.3	0.43	600.0	0.43	596.7	0.40
Juvenile English sole/ tidal channels	0	0	0	0	0	0	10.0	0.20	21.5	0.40	21.5	0.30	21.5	0.30
Juvenile English sole/ subtidal habitat	0	0	0	0	561.1	0.20	54.5	0.20	54.5	0.40	54.5	0.30	54.5	0.30
Wintering shorebird guild/mudflats	24.7	0.35	24.7	0.35	115.0	0.41	580.4	0.81	301.7	0.59	0	0	0	0
Wintering mallard/ tidal ponds	0	0	0	0	0	0	0	0	0	0	0	0	3.3	1.0

Table B-5. HSIs and acreages for the cover-types for all target years for future conditions without the project (TY0) and future conditions with the project (TY's 1-56) for Alternative 5 for the Hamilton Army Airfield Wetland Restoration Project.

SPECIES MODEL & COVER-TYPE	TY0		TY1		TY6		TY16		TY25		TY56	
	AREA	HSI	AREA	HSI	AREA	HSI	AREA	HSI	AREA	HSI	AREA	HSI
California vole/uplands	492.7	0.96	543.3	0	84.7	0.96	84.7	0.96	84.7	0.96	84.7	0.96
California ground squirrel/uplands	492.7	0.21	543.3	0	84.7	0.21	84.7	0.21	84.7	0.21	84.7	0.21
Western meadowlark/ uplands	492.7	0.85	543.3	0	84.7	0.85	84.7	0.85	84.7	0.85	84.7	0.85
Desert cottontail/ seasonal wetlands	48.5	0	0	0	119.5	0.90	108.0	0.90	82.7	0.90	62.0	0.90
Wintering mallard/ seasonal wetlands	48.5	0.66	0	0	119.5	0.95	108.0	0.95	82.7	0.95	62.0	0.95
Wintering mallard/ non-tidal emergent marsh	4.1	0.88	0	0	2.0	0.93	2.0	0.93	2.0	0.93	2.0	0.95
Salt marsh rail guild/ tidal salt marsh	3.6	0	3.6	0	6.5	0.22	379.2	0.77	571.3	0.88	588.7	0.88
Egret guild/tidal salt marsh	3.6	0.36	3.6	0.36	6.5	0.26	379.2	0.34	571.3	0.40	588.7	0.40
Juvenile English sole/ tidal channels	0	0	0	0	0	0	21.5	0.40	21.5	0.30	21.5	0.30
Juvenile English sole/ subtidal habitat	0	0	0	0	28.3	0.20	54.5	0.40	54.5	0.30	54.5	0.30
Wintering mallard/ tidal pannes	0	0	0	0	40.5	0.70	40.5	0.70	40.5	0.70	40.5	0.70
Wintering shorebird guild/mudflats	24.7	0.35	24.7	0.35	575.7	0.84	148.8	0.44	0	0	0	0
Wintering mallard/ tidal	0	0	0	0	0	0	0	0	0	0	3.3	1.0

ponds													

Table B-6. Summary of changes in habitat area (acres) and value (Average Annual Habitat Units, or AAHUs) by cover-type for the Hamilton Army Airfield Wetlands Restoration Project, Alternative 2, Natural Sedimentation Alternative, HAAF.

COVER-TYPE	HSI MODEL	WITHOUT-THE-PROJECT (Acres at TY0)	WITH-THE-PROJECT (Acres at TY52)	NET CHANGES FOR WITH-THE-PROJECT		
				Acres at TY52	**AAHUs at TY52 for each HSI model**	**Average of AAHUs at TY52 for each cover-type[2]**
Tidal emergent marsh	Egret guild	3.0[1]	395.2	+392.2	+117.68	+175.87
	Salt marsh rail guild				+234.05	
Seasonal wetlands	Desert cottontail	32.5	43.2	+10.7	+36.81	+26.75
	Wintering mallard				+16.69	
Uplands	California vole	258.7	35.8	-222.9	-221.35	-155.25
	California ground squirrel				-48.42	
	Western meadowlark				-195.98	
Tidal channels	Juvenile English sole	0	14.0	+14.0	+3.87	+3.87
Subtidal	Juvenile English sole	0	43.5	+43.5	+16.34	+16.34
Mudflats	Wintering shorebird guild	14.3[1]	0	-14.3	+54.97	+54.97
Tidal ponds	Wintering mallard	0	3.3	+3.3	+0.55	+0.55
Non-tidal emergent marsh	Wintering mallard	4.1	64.5	+60.4	+53.06	+53.06
Developed areas	(not analyzed in the HEP)	283.6	0	--	--	--
TOTALS:		596.2	596.2	--	--	Gains: +331.41 Losses: -155.25

[1]Acres are outboard of the project levee.

Table B-7. Summary of changes in habitat area (acres) and value (Average Annual Habitat Units, or AAHUs) by cover-type for the Hamilton Army Airfield Wetlands Restoration Project, Alternative 3, Natural Gradient Alternative, HAAF.

COVER-TYPE	HSI MODEL	WITHOUT-THE-PROJECT (Acres at TY0)	WITH-THE PROJECT (Acres at TY56)	NET CHANGES FOR WITH-THE-PROJECT		
				Acres at TY56	AAHUs at TY56 for each HSI model	Average of AAHUs at TY56 for each cover-type
Tidal emergent marsh	Egret guild	3.0[1]	397.2	+394.2	+125.51	+198.36
	Salt marsh rail guild				+271.20	
Seasonal wetlands	Desert cottontail	32.5	62.0	+29.5	+79.88	+70.16
	Wintering mallard				+60.43	
Uplands	California vole	258.7	41.2	-217.5	-230.00	-161.32
	California ground squirrel				-50.31	
	Western meadowlark				-203.64	
Tidal channels	Juvenile English sole	0	14.0	+14.0	+3.86	+3.86
Subtidal	Juvenile English sole	0	43.5	+43.5	+12.86	+12.86
Mudflats	Wintering shorebird guild	14.3[1]	0	-14.3	+39.92	+39.92
Tidal ponds	Wintering mallard	0	3.3	+3.3	+0.68	+0.68
Tidal pannes	Wintering mallard	0	33.0	+33.0	+23.87	+23.87
Non-tidal emergent marsh	Wintering mallard	4.1	2.0	-2.1	-2.09	-2.09
Developed areas	(not analyzed in the HEP)	283.6	0	--	--	--
TOTALS:		596.2	596.2	--	--	Gains: +349.71 Losses: -163.41

[1]Acres are outboard of the project levee.

Table B-8. Summary of changes in habitat area (acres) and value (Average Annual Habitat Units, or AAHUs) by cover-type for the Hamilton Army Airfield Wetlands Restoration Project, Alternative 4, Natural Sedimentation Alternative, HAAF and SLCP.

COVER-TYPE	HSI MODEL	WITHOUT-THE-PROJECT (Acres at TY0)	WITH-THE-PROJECT (Acres at TY52)	NET CHANGES FOR WITH-THE-PROJECT		
				Acres at TY52	AAHUs at TY52 for each HSI model	Average of AAHUs at TY52 for each cover-type
Tidal emergent marsh	Egret guild	3.6[1]	596.7	+593.1	+171.92	+268.41
	Salt marsh rail guild				+364.89	
Seasonal wetlands	Desert cottontail	48.5	43.2	-5.3	+36.81	+21.29
	Wintering mallard				+5.77	
Uplands	California vole	492.7	73.5	-419.2	-417.93	-293.13
	California ground squirrel				-91.42	
	Western meadowlark				-370.04	
Tidal channels	Juvenile English sole	0	21.5	+21.5	+5.92	+5.92
Subtidal	Juvenile English sole	0	54.5	+54.5	+21.31	+21.31
Mudflats	Wintering shorebird guild	24.7[1]	0	-	+85.75	+85.75
Tidal ponds	Wintering mallard	0	3.3	+	+0.55	+0.55
Non-tidal emergent marsh	Wintering mallard	4.1	64.5	+60.4	+53.06	+53.06
Developed areas	(not analyzed in the HEP)	283.6	0	-	--	--
TOTALS:		857.2	857.2	-	--	Gains: +456.29 Losses: -293.13

[1]Acres are outboard of the project levee.

Table B-9. Summary of changes in habitat area (acres) and value (Average Annual Habitat Units, or AAHUs) by cover-type for the Hamilton Army Airfield Wetlands Restoration Project, Alternative 5, Natural Gradient Alternative, HAAF and SLCP.

COVER-TYPE	**HSI MODEL**	**WITHOUT-THE-PROJECT (Acres at TY0)**	**WITH-THE PROJECT (Acres at TY56)**	**NET CHANGES FOR WITH-THE-PROJECT**		
				Acres at TY56	**AAHUs at TY56 for each HSI model**	**Average of AAHUs at TY56 for each cover-type**
Tidal emergent marsh	Egret guild	3.6[1]	588.7	+585.1	+187.61	+299.94
	Salt marsh rail guild				+412.27	
Seasonal wetlands	Desert cottontail	48.5	62.0	+13.5	+79.88	+64.28
	Wintering mallard				+48.68	
Uplands	California vole	492.7	84.7	-408.0	-432.14	-303.10
	California ground squirrel				-94.53	
	Western meadowlark				-382.63	
Tidal channels	Juvenile English sole	0	21.5	+21.5	+5.93	+5.93
Subtidal	Juvenile English sole	0	54.5	+54.5	+16.33	+16.33
Mudflats	Wintering shorebird guild	24.7[1]	0	-24.7	+63.74	+63.74
Tidal ponds	Wintering mallard	0	3.3	+3.3	+0.68	+0.68
Tidal pannes	Wintering mallard	0	40.5	+40.5	+29.29	+29.29
Non-tidal emergent marsh	Wintering mallard	4.1	2.0	-2.1	-2.09	-2.09
Developed areas	(not analyzed in the HEP)	283.6	0	--	--	--
TOTALS:		857.2	857.2	--	--	Gains: +480.19 Losses: -305.19

1Acres are outboard of the project levee.

<u>Alternative 3, Dredge Material with Natural Gradient, HAAF</u>. The new acreages and cover-types that would be created with the project by TY 56 are: 394.2 acres of tidal emergent marsh, 29.5 acres of seasonal wetlands, 14.0 acres of tidal channels, 43.5 acres of subtidal habitat, 3.3 acres of tidal ponds, and 33.0 acres of tidal pannes. There would be a loss of 217.5 acres of uplands and 2.1 acres of non-tidal emergent marsh. Also, mudflats would be created with the project, but lost at the end of the life of the project. Results of the HEP analysis indicate there would be 1) a gain of 125.51 AAHUs with the egret guild and a gain of 271.20 AAHUs with the salt marsh rail guild for the tidal emergent marsh cover-type; 2) a gain of 79.88 AAHUs with the desert cottontail model and a gain of 60.43 AAHUs with the wintering mallard model for the seasonal wetlands cover-type; 3) a loss of 230.00 AAHUs with the california vole model, a loss of 50.31 AAHUs with the California ground squirrel model, and a loss of 203.64 AAHUs with the western meadowlark model for the uplands cover-type; 4) a gain of 3.86 AAHUs with the juvenile English sole model for the tidal channels cover-type; 5) a gain of 12.86 AAHUs with the juvenile English sole model subtidal cover-type; 6) a gain of 39.92 AAHUs with the wintering shorebird guild for the mudflats cover-type; 7) a gain of 0.68 AAHUs with the wintering mallard model for the tidal ponds cover-type; 8) a gain of 23.87 AAHUs with the wintering mallard model for the tidal pannes cover-type; and 9) a loss of 2.09 AAHUs with the wintering mallard model for the non-tidal emergent marsh cover-type.

The average AAHUs are: 1) +198.36 for tidal emergent marsh; +70.16 for seasonal wetlands; -161.32 for uplands; +3.86 for tidal channels; +12.86 for subtidal habitat; +39.92 for mudflats; +0.68 for tidal ponds; +23.87 for tidal pannes; and -2.09 for non-tidal emergent marsh. The total AAHU gains are 349.71 and losses are 163.41.

<u>Alternative 4, Natural Sedimentation and Cross-levee, HAAF and SLCP</u>. The new acreages and cover-types that would be created with the project by TY 52 are: 593.1 acres of tidal emergent marsh, 21.5 acres of tidal channels, 54.5 acres of subtidal habitat, 3.3 acres of tidal ponds, and 60.4 acres of non-tidal emergent marsh. There would be a loss of 419.2 acres of uplands and 5.3 acres of seasonal wetlands. Also, mudflats would be created with the project, but lost at the end of the life of the project. Results of the HEP analysis indicate there would be 1) a gain of 171.92 AAHUs with the egret guild and a gain of 364.89 AAHUs with the salt marsh rail guild for the tidal emergent marsh cover-type; 2) a gain of 36.81 AAHUs with the desert cottontail model and a gain of 5.77 AAHUs with the wintering mallard model for the seasonal wetlands cover-type; 3) a loss of 417.93 AAHUs with the california vole model, a loss of 91.42 AAHUs with the California ground squirrel model, and a loss of 370.04 AAHUs with the western meadowlark model for the uplands cover-type; 4) a gain of 5.92 AAHUs with the juvenile English sole model for the tidal channels cover-type; 5) a gain of 21.31 AAHUs with the juvenile English sole model subtidal cover-type; 6) a gain of 85.75 AAHUs with the wintering shorebird guild for the mudflats cover-type; 7) a gain of 0.55 AAHUs with the wintering mallard model for the tidal ponds cover-type; and 8) a gain of 53.06 AAHUs with the wintering mallard model for the non-tidal emergent marsh cover-type.

The average AAHUs are: 1) +268.41 for tidal emergent marsh, +21.29 for seasonal wetlands; -293.13 for uplands; +5.92 for tidal channels; +21.31 for subtidal habitat; +85.75 for mudflats; +0.55 for tidal ponds; and +53.06 for non-tidal emergent marsh. The total AAHU gains are 456.26 and losses are 293.13.

Alternative 5, Dredged Material with Natural Gradient, HAAF and SLCP. The new acreages and cover-types that would be created with the project by TY 52 are: 585.1 acres of tidal emergent marsh, 13.5 acres of seasonal wetlands, 21.5 acres of tidal channels, 54.5 acres of subtidal habitat, 3.3 acres of tidal ponds, and 40.5 acres of tidal pannes. There would be a loss of 408.0 acres of uplands and 2.1 acres of non-tidal emergent marsh. Also, mudflats would be created with the project, but lost at the end of the life of the project. Results of the HEP analysis indicate there would be 1) a gain of 187.61 AAHUs with the egret guild and a gain of 412.27 AAHUs with the salt marsh rail guild for the tidal emergent marsh cover-type; 2) a gain of 79.88 AAHUs with the desert cottontail model and a gain of 48.68 AAHUs with the wintering mallard model for the seasonal wetlands cover-type; 3) a loss of 432.14 AAHUs with the california vole model, a loss of 94.53 AAHUs with the California ground squirrel model, and a loss of 382.63 AAHUs with the western meadowlark model for the uplands cover-type; 4) a gain of 5.93 AAHUs with the juvenile English sole model for the tidal channels cover-type; 5) a gain of 16.33 AAHUs with the juvenile English sole model subtidal cover-type; 6) a gain of 63.74 AAHUs with the wintering shorebird guild for the mudflats cover-type; 7) a gain of 0.68 AAHUs with the wintering mallard model for the tidal ponds cover-type; 8) a gain of 29.29 AAHUs with the wintering mallard model for the tidal pannes cover-type; and 9) a loss of 2.09 AAHUs with the wintering mallard model for the non-tidal emergent marsh cover-type.

The average AAHUs are: 1) +299.94 for tidal emergent marsh; +64.28 for seasonal wetlands; -303.10 for uplands; +5.93 for tidal channels; +16.33 for subtidal habitat; +63.74 for mudflats; +0.68 for tidal ponds; +29.29 for tidal pannes; and -2.09 for non-tidal emergent marsh. The total AAHU gains are 480.19 and losses are 305.19.

An obvious similarity amongst the four alternatives is that net gains in AAHUs would occur for tidal emergent marsh, seasonal wetlands, tidal channels, subtidal habitat, mudflats, and tidal ponds, and net losses would occur for uplands. There are several differences amongst the alternatives as well. For Alternatives 3 and 5, there would be a gain, of course, in AAHUs for tidal pannes, and a loss in AAHUs for non-tidal emergent marsh habitat. Alternatives 2 and 4 would initially allow more tidal emergent marsh creation (more acres at TY 6 than Alternatives 3 and 5), but by TY 16, Alternatives 3 and 5 would allow more creation of tidal emergent marsh, due to the fact that dredged material helped “speed the process along” of tidal emergent marsh. Alternatives 3 and 5 would allow the creation of tidal pannes seasonal wetlands would be created more quickly using Alternatives 1 and 2. HSI values for each cover-type and each alternative would be fairly similar, however, by the end of the period of analysis (TY 52 for Alternatives 2 and 4, and TY 56 for Alternatives 3 and 5). Total AAHU net gains for Alternatives 3 and 5, however, AAHU net losses are also higher for Alternatives 3 and 5. The higher net gains for Alternatives 3 and 5 are due to higher AAHU values for tidal emergent marsh, seasonal wetlands, tidal ponds, and tidal pannes (of which there are none for Alternatives 2 and 4). Alternatives 2 and 4 had higher AAHU net gains for only subtidal habitat, mudflats, and non-tidal emergent marsh. Net changes in AAHUs for tidal channels were slightly higher for Alternative 2 than Alternative 3, but slightly lower for Alternative 4 than Alternative 5.

Overall, each proposed alternative appears to have positive net benefits for fish and wildlife in the project area from the potential the creation of tidal emergent marsh, seasonal wetlands, tidal channels, subtidal habitat, temporary mudflats, tidal ponds, and tidal pannes (for Alternatives 3 and 5). However, until more information is received (see “Recommendations” section), is it not possible for the Service to recommend one Alternative over the other at this time.

RECOMMENDATIONS

If the project is constructed, the Service recommends that the Corps implement the following:

For disposal of "cover" material at the HAAF and SLCP site:

1. Defer the dredge material disposal alternatives (Alternatives 3 and/or 5) at the HAAF and SLCP sites until such time that 5 years of post-construction monitoring data from the Sonoma Baylands site are available. Until this is completed, the Service defers a recommendation concerning the alternative designs of the site.

2. Evaluate the Sonoma Baylands monitoring data and other similar restoration projects, and refine the HAAF and SLCP sites concept design to maximize success.

However, if the project is pursued prior to obtaining such data, implement recommendations 3-16 below:

1. Avoid impacts to existing wetland habitats (specifically the Corps-delineated saltgrass-saltmarsh wetland and saltgrass-alkali heath wetland), by not grading over them during site preparation activities. These wetlands currently contain good foraging and cover habitat for a number of species, such as waterfowl.

2. Minimize impacts to the grassland/herbaceous cover-type by reseeding all impact areas of the upland herbaceous habitat not within the newly created tidal inundation zone, including all staging and access areas, with native grasses and forbs. Also, reseed all levees and dikes in the area. Conduct reseeding just prior to the rainy season to enhance germination and plant establishment. The estimated cost to reseed the affected areas is $800/acre.

3. Minimize contaminant exposure following restoration to tidal action by: a) designing any containment "caps" over residual contaminated soils to withstand tidal action, especially in areas where channels would be constructed or may form; b) conducting random testing of biota, sediment quality, surface water, groundwater, and decant water for compliance with levels determined to not cause injury to trust resources; and c) monitoring for the potential movement of contaminants from dredged material to surrounding soils or water.
4. Minimize impacts to wildlife by creating a transitional upland area, especially between developed areas (such as where the New Hamilton Partners property lies to the west) and the proposed tidal restoration site, which would include a slope of at least 100 feet. A wider buffer may be required to protect specific habitat needs of resident endangered species, such as the California clapper rail.

5. Implement the following, pursuant to section 7 of the Endangered Species Act: a) determine the potential effects of the proposed project on listed, proposed, and candidate species or critical habitat, by conducting surveys for the species or potential habitat, as appropriate (refer to Appendix C for a list of these potentially affected species; b) should any listed or proposed species or critical habitat be present, complete a Biological Assessment to determine whether the project may affect the species or critical habitat; c) should the proposed action be likely to adversely affect the species or its critical habitat, initiate formal consultation with the Service or NMFS, as appropriate; and d) implement the following to minimize potential adverse effects to the California clapper rail and salt marsh harvest mouse: i) avoid potential impacts to breeding California clapper rails by: ceasing construction work on levees (or laying of pipelines to convey dredged materials) within 250 feet of suitable clapper rail habitat during the clapper rail breeding season (February 1 through August 31), and locating such pipelines outside of suitable clapper rail habitat; and ii) minimize potential death or injury to the salt marsh harvest mouse by constructing exclusion fences where potential impacts may occur to suitable harvest mouse habitat, and trapping within the fences according to Service-approved methodology. A final determination will be made during the section 7 consultation regarding recommendations for avoidance measures for the species.

6. Develop, and provide to the Service, a more complete and detailed design, including a map of target elevations and cover-types, locations of major channels and levee breaches, etc. The design should take into account the need to underfill marshes to allow for natural sedimentation over the dredged material. Hydrologic modeling should be conducted to size and locate the channels and breaches.

7. Determine the capability of vegetation successfully growing in the dredged material, which would be composed mainly of sandy material, after it is deposited.

8. Develop a final monitoring plan, subject to the review and approval by the Service and other appropriate agencies, before the placement of any dredged materials on-site. Include in this monitoring plan the following components: a) a field and/or lab assessment of the

bioaccumulation of trace metals and organochlorines in intertidal organisms; b) quantification of wildlife activity; and c) quantification of changes to adjacent outboard wetland habitats.

9. Provide the following for Service evaluation: a) rates of sedimentation following restoration to tidal action; b) identify constraints imposed by toxic remediation such as location of channels and minimum cover levels; and c) identify any relevant flood control considerations including, but not limited to, pumping of surface waters from adjacent areas.

10. Design the project to ensure continued functioning of 33-acre seasonal wetland/adjacent upland parcel which was created as mitigation for closure of Landfill 26.

11. Coordinate the habitat restoration and enhancement design for the HAAF with the revised Master Plan and any mitigation proposal for Bel Marin Keys Unit 5 and other adjacent parcels that have potential for tidal marsh restoration.

12. Investigate further the following: a) frequency, duration, velocity, and elevation of tidal flooding at the site; b) water quality, circulation and flushing conditions from both the Bay and freshwater sources; c) existing and target ground elevations, given that site elevations are presently below mean sea level; d) measures to achieve conditions favorable to sedimentation and wetlands plant establishment; e) mosquito abatement control needs; f) location of cuts in the bayward levee and the need to cut through existing tidal wetlands and mudflats; and g) long-term management and monitoring requirements.

13. Develop a public access component for the project. The provision of public access that would increase public appreciation and use of the shoreline and that is compatible with protection of resource values will need careful design and review.

14. Consider the “additional information needs related to base closure, Novato Sanitary District Facilities, and Adjacent Properties” and implement the proposed “wetland design development studies” found on pages 7-1 through 7-2 in the draft “Executive Summary” for the “Hamilton Wetlands Conceptual Restoration Plan” (Woodward-Clyde, *et al.* 1998). Although all information needs and studies are important, we are especially interested in studies that would: a) refine estimates of the time frame for tidal wetlands creation; b) refine the proposed internal peninsula design; c) allow observation of vegetation and hydrologic characteristics of similar seasonal wetlands created on sand and dredged bay mud substrates; and d) refine the tidal panne design.

15. Modify the existing design for all alternatives in order to use dredge material to allow high marsh to form around the interior edges of the HAAF and SLCP sites (about 200 feet out), and then allow natural sedimentation create cover-types on the remainder of the interior.

16. Complete all investigations of the SLCP site so that the area can be accessed by the Service in order for us to complete the HEP analysis.

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PERSONAL COMMUNICATIONS

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